Vol. 105
No. 2721

Pages 191-216

February 21, 1947

# Science

THE SCIENTISTS NEWSWEEKLY

Directors of principal research centers in conference regarding the first report (p. 199) of the Atomic Energy Commission. Left to right, first row: F. H. Spedding, Iowa State College, Carroll L. Wilson, General Manager, Atomic Energy Commission; and C. G. Suits, General Electric Laboratory, Schenectady, New York; second row: E. O. Lawrence, University of California; P. M. Morse, Brookhaven National Laboratory, Patchogue, New York; Eugene P. Wigner, Clinton Laboratories, Oak Ridge, Tennessee; and W. H. Zinn, Argonne National Laboratory, Chicago.

Published by the
AMERICAN
ASSOCIATION
FOR THE
ADVANCEMENT
OF SCIENCE

## Proposed National Science Foundation, 1947

**Editor:** Willard L. Valentine

**Assistant Editor** Mildred Atwood

**Business Manager** Theo. J. Christensen

**Publications Committee**
Roger Adams, John E. Flynn, Kirtley F. Mather, Walter R. Miles, W. J. Robbins, Malcolm H. Soule

# Science

Vol. 105 No. 2721 Friday, February 21, 1947

# CONTENTS



(*Cover photograph by Press Association, Inc.*)

**Science**, a weekly journal, is published each Friday by the American Association for the Advancement of Science at Mt. Royal & Guilford Avenues, Baltimore 2, Maryland. Founded in 1880, it has been since 1900 the official publication of the AAAS. Editorial, Advertising, and Circulation Offices, 1515 Massachusetts Avenue, N.W., Washington 5, D. C. Telephone, EXecutive 6060 or 6061.

**Articles** offered for publication should be sent to the Editor, 1515 Massachusetts Avenue, N.W., Washington 5, D. C.

**Membership correspondence** for the AAAS should be sent to the Administrative Secretary, 1515 Massachusetts Avenue, N.W., Washington 5, D. C.

**Change of address.** Four weeks notice required for change of address. When ordering a change, please furnish an address stencil label from a recent issue. Address changes can be made only if the old as well as the new address is supplied.

**Annual subscription,** \$7.50; single copies, \$.25; foreign postage (outside the Pan-American Union), \$1.00 extra, Canadian postage, \$.50 extra. Remittances and orders for subscriptions and for single copies, notices of changes of address, and claims for missing numbers should be sent to the Circulation Department.

Entered as second-class matter July 18, 1923, at the postoffice at Lancaster, Pennsylvania, under the act of March 3, 1879. Re-entered as second-class mailing matter under the act of March 3, 1879, January 17, 1947, at Baltimore, Maryland.

# Proposed National Science Foundation Act, 1947: S. 526

*A bill introduced into the Senate of the United States on February 7, 1947, by H. Alexander Smith, Guy Cordon, Chapman Revercomb, Leverett Saltonstall, Warren G. Magnuson, and J. W. Fulbright.*

SEC. 2. THERE IS HEREBY ESTABLISHED in the executive branch of the Government an independent agency to be known as the National Science Foundation.

### Membership of Foundation

SEC. 3. (a) The Foundation shall have forty-eight members to be appointed by the President, by and with the advice and consent of the Senate. The persons nominated for appointment as members (1) shall be outstanding men and women who are recognized leaders in the fields of the fundamental sciences, medical science, engineering, education, or public affairs; (2) shall be selected solely on the basis of established records of distinguished service and without regard to political, social, or religious factors; and (3) shall be so selected as to provide representation of the views of scientific leaders in all areas of the Nation. The President is requested, in the making of nominations of persons for appointment as members, to give due consideration to any recommendations for nomination which may be submitted to him by the National Academy of Sciences or by other scientific or educational organizations.

(b) The term of office of each member of the Foundation shall be eight years, except that (1) any member appointed to fill a vacancy occurring prior to the expiration of the term for which his predecessor was appointed shall be appointed for the remainder of such term; and (2) the terms of office of the members first taking office after the date of enactment of this Act shall expire, as designated by the President at the time of appointment, twelve at the end of two years, twelve at the end of four years, twelve at the end of six years, and twelve at the end of eight years, after the date of enactment of this Act. No person who has served as a member of the Foundation for more than four years shall be eligible for reappointment as a member until the expiration of four years after the termination of his previous term.

(c) The President shall designate one of the original members of the Foundation to act as chairman of the Foundation until such time as the executive committee referred to in Section 5 (a) is elected and chooses its chairman as provided for by Section 5 (b). The member so designated shall call the first meeting of the members of the Foundation and shall preside over such meeting until a chairman has been chosen.

### Powers and Duties of the Foundation

SEC. 4. (a) The Foundation is authorized: (1) to develop, and to encourage the pursuit of, a national policy for scientific research and scientific education; (2) to initiate and support basic scientific research in the mathematical, physical, medical, biological, engineering, and other sciences, by making contracts or other arrangements (including grants, loans, and other forms of assistance) for the conduct of such basic scientific research; (3) to initiate and support scientific research in connection with matters relating to the national defense by making contracts or other arrangements (including grants, loans, and other forms of assistance) for the conduct of such scientific research; (4) to grant scholarships and graduate fellowships in the mathematical, physical, medical, biological, engineering, and other sciences; (5) to foster the interchange of scientific information among scientists in the United States and foreign countries; and (6) to correlate the Foundation's scientific research programs with those undertaken by individuals and by public and private research groups.

(b) The members of the Foundation shall meet at the call of the Chairman but not less frequently than once each year. A majority of the members of the Foundation shall constitute a quorum. Each member shall be given notice, by registered mail mailed to his last-known address of record not less than fifteen days prior to any meeting, of the call of such meeting.

### Creation and Powers and Duties of the Executive Committee

SEC 5. (a) The Foundation shall elect biennially from its own membership an executive committee composed of nine members which shall, except as otherwise provided in this Act, exercise the powers and duties of the Foundation. The executive committee may delegate or assign to officers, employees, and divisions, within the Foundation, any of its powers, duties, and functions.

(b) The executive committee shall choose its own chairman and vice-chairman biennially, who shall also serve as chairman and vice-chairman of the Foundation. The vice-chairman shall perform the duties of the chairman in his absence.

(c) The executive committee shall meet at the call of the chairman or at such times as may be fixed by itself, but not less than six times each year.

(d) Five members of the executive committee shall constitute a quorum.

(e) The executive committee may establish such advisory committees as it may determine to be necessary or desirable for the consideration of programs administered by the Foundation.

(f) The executive committee shall render an annual report to the Foundation, for submission to the President and the Congress, summarizing the activities of the Foundation and making such recommendations as it may deem appropriate.

### Director of Foundation

Sec. 6. The Foundation shall have a chief executive officer, who shall be known as the Director of the Foundation. The powers and duties of the Director shall be prescribed by the executive committee and shall be exercised and performed by him under the supervision of such committee. The Director shall be appointed by the executive committee, with the approval of a majority of the members of the Foundation. The Director shall receive compensation at the rate of $15,000 per annum.

### Divisions Within the Foundation

Sec. 7. (a) There shall be within the Foundation a Division of National Defense and such other divisions as the Foundation may, from time to time, deem necessary. Each such division shall exercise such powers and perform such duties of the Foundation as may be prescribed by the Foundation.

(b) Until otherwise provided by the Foundation, there shall be within the Foundation: (1) a Division of Medical Research, which shall administer programs of the Foundation relating to research in the medical sciences; (2) a Division of Mathematical, Physical, and Engineering Sciences, which shall administer programs of the Foundation relating to research in the mathematical, physical, and engineering sciences; (3) a Division of Biological Sciences, which shall administer programs of the Foundation relating to research in the biological sciences; (4) a Division of National Defense, which shall administer programs of the Foundation relating to research on military and naval matters; and (5) a Division of Scientific Personnel and Education, which shall administer programs of the Foundation relating to the granting of scholarships and graduate fellowships in the mathematical, physical, medical, biological, engineering, and other sciences.

### Divisional Committees

Sec. 8. (a) There shall be a committee for each division of the Foundation.

(b) Each divisional committee, except the Committee for the Division of National Defense, shall be appointed by the Foundation and shall consist of not less than five persons who may be members or nonmembers of the Foundation.

(c) The Committee for the Division of National Defense shall consist of members in a number which is a multiple of four, to be fixed by the Foundation, but which shall be not less than eight and not more than forty. One-half of the members of such committee shall be civilians appointed by the Foundation, and the remaining half shall be representatives of the War and Navy Departments, designated in equal numbers by the Secretary of War and the Secretary of the Navy, respectively. There shall be within the divisional committee for the Division of National Defense an executive committee of five, consisting of the chairman of the divisional committee, as chairman; two civilian members of such committee elected annually by the civilian members thereof; one member of such committee representing the War Department and designated by the Secretary of War, and one member of such committee representing the Navy Department and designated by the Secretary of the Navy. Such executive committee shall perform such functions as may be prescribed by the Committee for the Division of National Defense with the approval of the Foundation.

(d) The term of each member of each divisional committee shall be fixed by the appointing or designating authority. Each divisional committee shall annually elect its own chairman from among its own members, and shall prescribe its own rules of procedure.

(e) Each divisional committee shall have the power and duty to make recommendations to, and advise and consult with, the executive committee and the Director with respect to matters relating to the program of its division, and shall have such additional powers and duties as the Foundation may delegate or assign to it.

(f) The Committee for the Division of National Defense shall establish regulations and procedures for the security classification of information or property in connection with scientific research (having military significance) under this Act, and for the proper safeguarding of any information or property so classified.

### Scholarships and Graduate Fellowships; Register of Scientific Personnel

Sec. 9. (a) The Foundation is authorized to award scholarships and graduate fellowships for scientific study or scientific work in the mathematical, physical, medical, biological, engineering, and other sciences at accredited nonprofit American or foreign institutions of higher education, selected by the recipient of such aid, for such periods as the Foundation may determine. Persons shall be selected for such scholarships and fellowships solely on the basis of ability; but in any case in which two or more applicants for scholarships or fellowships, as the case may be, are deemed by the Foundation to be possessed of equal ability and there are not sufficient scholarships or fellowships, as the case may be, available to grant one to each of such applicants, the Foundation shall award the available scholarship or scholarships or fellowship or fellowships to the applicants in such manner as will tend to result in a wide distribution of scholarships and fellowships among the States, Territories, possessions, and the District of Columbia.

(b) The Foundation shall maintain a register of scientific and technical personnel and in other ways provide a central clearinghouse for information covering all scientific and technical personnel in the United States and its possessions. No individual shall be listed in such register without his consent.

### Authority of Foundation

Sec. 10. The Foundation is empowered to do all things necessary to carry out the provisions of this Act and, without being limited thereby, the Foundation is specifically authorized: (a) to prescribe such rules and regulations as it deems necessary governing the manner of its operations and its organization and personnel; (b) to make such expenditures as may be necessary for carrying out the provisions of this Act; (c) to enter into contracts or other arrangements for the carrying on, by organizations or individuals, including other Government agencies, of such scientific research activities as the Foundation deems necessary to carry out the purposes of this Act; (d) to enter into such contracts or other arrangements, or modifications thereof, without legal consideration, without performance or other bonds, and without regard to section 3709 of the Revised Statutes (41 U. S. C., Sec. 5); (e) to make advance, progress, and other payments which relate to scientific research without regard to the provisions of Section 3648 of the Revised Statutes (31 U. S. C., Sec. 529); (f) to acquire by purchase, or otherwise, hold and dispose of by sale, lease, loan, or otherwise, real and personal property of all kinds necessary for, or resulting from, scientific research without regard to the provisions of law relating to the acquisition, holding, or disposition of property by the United States; (g) to receive and use funds donated by others, if such funds are donated, without restriction, other than that they be used in furtherance of one or more of the general purposes of the Foundation; (h) to publish or arrange for the publication of scientific and technical information so as to further the full dissemination of information of scientific value consistent with the national interest, without regard to the provisions of Section 87 of the Act of January 12, 1895 (28 Stat. 622), and Section 11 of the Act of March 1, 1919 (40 Stat. 1270; 44 U. S. C., Sec. 111); (i) to accept and utilize the services of voluntary and uncompensated personnel and to pay the actual and necessary traveling and subsistence expenses (including, in lieu of subsistence, per diem allowances at a rate not in excess of $10) of such personnel incurred in the course of such services; and (j) to prescribe, with the approval of the Comptroller General of the United States, the extent to which vouchers for funds expended under contracts for scientific research shall be subject to itemization or substantiation prior to payment, without regard to the limitations of other laws relating to the expenditure of public funds and accounting therefor.

### Patent Rights

Sec. 11. (a) Each contract or other arrangement executed by the Foundation which relates to scientific research shall contain provisions governing the disposition of inventions produced thereunder in a manner calculated to protect the public interest and the equities of the individual or organization with which the contract or other arrangement is executed.

(b) All inventions produced by employees of the Foundation in the course of their assigned activities for the Foundation shall be made freely available to the public, or, if patented, shall be freely dedicated to the public.

### International Cooperation

Sec. 12. (a) The Foundation is hereby authorized, with the approval of the President and through the Department of State, to cooperate in any international scientific research activities consistent with the purposes or provisions of this Act and to expend for such international scientific research activities such sums within the limit of appropriated funds as the Foundation may deem desirable.

(b) The Foundation may defray the expenses of representatives of Government agencies and other organizations and of individual scientists to accredited international scientific congresses and meetings whenever it deems it necessary in the promotion of the objectives of this Act.

### Appropriations

Sec. 13. (a) To enable the Foundation to carry out its powers and duties, there is hereby authorized to be appropriated annually to the Foundation, out of any money in the Treasury not otherwise appropriated, such sums as may be necessary to carry out the provisions of this Act.

(b) The funds hereafter appropriated to the Foundation, as herein authorized, shall, if obligated during the fiscal year for which appropriated, remain available for expenditure for four years following the expiration of the fiscal year for which appropriated. After such four-year period, the unexpended balances of appropriations shall be carried to the surplus fund and covered into the Treasury.

### Interdepartmental Committee on Science

Sec. 14. (a) There is hereby established an Interdepartmental Committee on Science, to consist of the Director of the Foundation, as chairman, and the heads (or their designees) of such Government agencies engaged in or concerned with the support of scientific activity to a substantial degree as the President may from time to time determine. The interdepartmental committee shall meet whenever the chairman so determines, but not less than once a month.

(b) The Interdepartmental Committee on Science shall gather and correlate data relating to the scientific research and scientific development activities of the Federal Government; and shall make such recommendations to the President, the Foundation, and other governmental agencies as in the opinion of the committee will serve to aid in effectuating the objectives of this Act and of other legislation providing for Federal support of scientific research and scientific development.

### General Provisions

Sec. 15. (a) The Director shall appoint and fix the compensation of such personnel as may be necessary to carry out the provisions of this Act. Such appointments shall be made and such compensation shall be fixed in accordance with the provisions of the civil service laws and regulations and the Classification Act of 1923, as amended, except that, when deemed desirable by the Director, technical and professional personnel may be employed without regard to the civil service laws or regulations, and their compensation may be fixed without regard to the provisions of the Classification Act of 1923, as amended. The Deputy Director hereinafter provided for, and the members of the divisional committees and advisory committees, shall be appointed without regard to the civil service laws or regulations.

(b) The Director may appoint with the approval of the executive committee a Deputy Director who shall receive compensation at a rate of not to exceed $12,000 per annum.

(c) The Foundation shall not, itself, operate any laboratories or pilot plants.

(d) The members of the Foundation, and the members of each divisional committee and of each advisory committee appointed by the Foundation, shall receive compensation at the rate of $50 for each day engaged in the business of the Foundation, and shall be allowed actual and necessary traveling and subsistence expenses (including, in lieu of subsistence, per diem allowances at a rate not in excess of $10) when engaged, away from home, in the duties of their offices.

(e) Persons holding other offices in the executive branch of the Federal Government may serve as members of the divisional committees or of any advisory committee appointed by the Foundation, but they shall not receive remuneration for their services as such members during any period for which they receive compensation for their services in such other offices.

(f) Service of an individual as a member of the Foundation or of a divisional committee or of an advisory committee shall not be considered as service bringing him within the provisions of Section 109 or Section 113 of the Criminal Code (U. S. C., 1940 edition, Title 18, Secs. 198 and 203) or Section 19 (c) of the Contract Settlement Act of 1944, unless the act of such individual, which by some section is made unlawful when performed by an individual referred to in such section, is with respect to any particular matter which directly involves the Foundation or in which the Foundation is directly interested.

(g) The Office of Scientific Research and Development is abolished, and its affairs shall be liquidated by the Foundation, which shall be its successor agency. The property, records, funds (including all unexpended balances of appropriations or other funds now available), and contracts (and rights and obligations thereunder) of the Office of Scientific Research and Development are transferred to the Foundation. Such abolition and transfer shall take effect as of the date upon which five members of the executive committee provided for in Section 5 have qualified and taken office.

(h) In making contracts or other arrangements for scientific research, the Foundation shall utilize appropriations available therefor in such manner as will in its discretion best realize the objectives of (1) having the work performed by the organizations or individuals, including Government agencies, best qualified by training and experience to achieve the results desired, and (2) strengthening the research staff of organizations, particularly nonprofit organizations, in the States and Territories and the District of Columbia.

(i) The activities of the Foundation shall be construed as supplementing and not superseding, curtailing, or limiting any of the functions or activities of other Government agencies (except the Office of Scientific Research and Development) authorized to engage in scientific research or scientific development.

**On January 14 Representative Emanuel Celler introduced a bill, now called H. R. 942, which is identical with S. 1850 of the last session as it passed the Senate Military Affairs Committee. Simultaneously, on February 10, Representatives Case, Mills, and Priest introduced into the House bills now numbered H. R. 1815, 1830, and 1834. These three bills are identical to the Smith measure, S. 526, the text of which is given above.**

# The Shortage of Scientific Personnel

**Henry Allen Moe,** ***Secretary General,***
***John Simon Guggenheim Memorial Foundation, New York City***

As a lawyer, unfortunately I am no authority on the history of science or the history of support for science; but since my early days at the Foundation, beginning in 1924, I have been aware of the fight made and won for financial support for science in the United States. After World War I the discussion centered about the worth-whileness of support of science. Would it pay out in social return? In the light of what has happened, the labored arguments of those days have the appearance of insisting upon the obvious; but it is worth remembering that it was a real issue then.

No one in this day needs to argue the necessity for a healthy and adequate science in this country. We need, however, to put into the record now *why* the situation in respect to scientific personnel in the United States is a serious one.

It is partly because, in our usual way when we set out to do a job, we do it to the exclusion of everything else—the long-term considerations always can go hang. We set out to do the job of winning the war to the whole extent of our ability to contribute to victory, and that is the job we did. We stopped almost completely the training of men not only in fields of science and technology but in all fields. With the exception of students of medicine and engineering in Army and Navy programs and some 2,400 men on the reserve list who were taken from their studies for civilian war research, all physically fit students, graduate and undergraduate, and those ready for college over 18 years old, were taken into the armed forces and were kept there. This went on for five years. What you take five years to undo in reference to training people for a vital function in the Nation's interest, you cannot make up in any lesser amount of time. And unless you do twice as much training for five years following the five blank years as you were doing before those years, you are going to lose up to five years of production of scientists. This is just elementary arithmetic and, furthermore, serious as arithmetic shows the situation to be, there is no doubt that a higher calculus, if it could be made, would show it to be still more serious.

Those of us who wrote the report on the fourth question of President Roosevelt's letter to Dr. Bush, concerning the discovery and development of scientific talent, looked long and hard at a lot of figures concerned with the Nation's future needs for personnel in science and technology. In the end we confessed that we knew no way to calculate the Nation's future needs for scientists and engineers. We all were convinced, however, that the needs would be greater in the future than they had been in the past.

In 1919 George Ellery Hale quoted with approval a statement by De Tocqueville in *Democracy in America*: "The French made surprising advances in the exact sciences at the very time when they were completing the destruction of the remains of their former feudal society; yet this sudden fecundity is not to be attributed to democracy, but to the unexampled revolution which attended its growth." And Dr. Hale himself similarly concluded: "The intellectual stimulus accompanying great upheavals, however they originate, finds expression in unusual achievements in science."

However valid these theories may be, the situation, here and now, is, in short, that we stopped for five years doing what it takes six years to do—that is, taking an 18-year-old and training him to the point where he is a producing scientist—and then, at the end of the five-year stoppage, we are faced with an increased and increasing demand for the product.

My Committee on the Bush Report, if I may use a convenient shorthand, concluded that the magnitude of the problem was such that the best prospect for solving it was through the Federal Government. We proposed both short-term ways and a long-term way of doing something about the problem. The short-term ways all were related to what the Army and Navy ought to do following V-E Day. None of these, we judged, would in any way weaken the war effort against Japan. But none of those things was done, and that water is all under the bridge, although I am going to say for the record that those short-term plans look, in retrospect, even better than they did at the time they were made. We pointed out that, in our judgments and in that of all patriotic informed citizens—at least we could discover no contrary views—amelioration of the scientific deficits then piling up was necessary for military security, good public health, full employment, a higher standard of living after the war, and, indeed, from whatever angle anyone looked at the situation. But, as indicated, we drew a blank on any results from those recommendations.

### Long-Term Proposals

We studied the evidence concerned with the Nation's future needs for scientists and engineers, and, having

**Based on an address delivered before the Symposium on the Shortage of Scientific Personnel, AAAS Boston Meeting, December 28, 1946.**

regard to what appeared to be reasonable prospects for assistance in training them from colleges, universities, private sources, foundations, and local and state governments, we concluded that provision of scholarships for about 24,000 students of science and technology with 6,000 entering a year would be about right, with additional provision for about 300 graduate fellowships annually. There was not in our minds any sense of sacredness of these figures: the future might revise them down or up without objection from us; nor were we so naïve as to think that these scholarship and fellowship provisions would increase the supply of scientists and engineers by the annual figures of recommended scholarships and fellowships, for we knew that Federal money in the area of science and technology would drive other money, or at least some of it, into other areas. This, in my view, would be a good thing.

I have been asked *why*, since we had gotten as far as we had scientifically and technologically, and *why*, if the greatest war of all time was won on the basis of scientific advance, we need to discover and train *x* thousand more scientists a year.

The question may not sound sensible to readers of *Science*, but it makes sense, I assure you, to lots of people. Personally, I have respect for the question, and to the askers of it I respond as thoughtfully as I can.

It is a wholly safe assumption that in the United States, before the present overloading of all institutions of higher learning, practically all young people of brains and character who knew what they wanted and who could afford to pay for it could get a scientific or technological or any other education. It is also reasonably safe to assume that the total number of those who wanted and who could pay for a scientific or technological education got that education. But now, on all the evidence we can find, that prewar total will not be enough to satisfy the Nation's needs for scientists and engineers. Hence, we must increase the prewar total.

You will have noted that there are two conditions to my statement about the total number of persons who got a scientific or technological education in prewar days: first, that they knew they wanted a scientific education and, secondly, that they could afford to pay for it.

The first of these conditions is tantamount to saying that somewhere they must have been in touch with science, and that means usually in a good secondary school. But it is painfully true that in some parts of the country good secondary schools are rare. Where this condition holds, there will be much loss of high ability to training, simply because that high ability does not get interested in further training—in science or in any other field of the mind and spirit. Although I recognize this, I am not a perfectionist, and I would propose that before we, as a nation, tackle this situation we take first an easier road to producing more trained minds.

That easier road, which is also cheaper and quicker, is to select those young persons who want to go on in their studies, who have shown that they have the brains and character for it, but who cannot afford it—select them on their merits and pay for their education on a modest scale of payment. There are reliable studies which show that the probability of college attendance for a high school graduate who is the child of a professional father is several times higher than for the child of a laborer. Other studies show that a large percentage of superior high school students do not get higher education simply because their parents cannot afford to pay for it.

The intelligence of a country's citizenry is obviously its greatest natural resource. Yet here we are wasting an appreciable part of ours by not giving it a chance to develop through higher education. We provide higher instruction at a very low charge to the student; but we pay very little attention to the important question of what he is going to use for subsistence money while obtaining the instruction. We provide board, lodging, and institutional care for our feeble-minded; but lots of people have the idea that to provide food and lodging for our best young minds during the period of their education somehow is wrong, or at least is not a proper function of government.

However, we who wrote the report on scientific personnel in the Bush Report saw it as an entirely proper function of government, and we proposed to select 6,000 of these fine young minds each year and stake them, with modest subsistence money, to a scientific or technological education that they otherwise probably would not get. This would cost about $20,000,000 a year; but if anyone has figured out how better to spend such a sum annually for the long-term good of our country, it has not come to my notice. Also, if there is anything wrong with spending Federal money for such a purpose, I have not yet heard where the wrong lies.

My Committee on the Bush Report was charged with formulating a plan for the discovery and development of scientific talent in American youth, and we did what we were asked to do: we confined our recommendations to scientific talent. We also pointed out[1] that:

> The statesmanship of science . . . requires that science be concerned with more than science. Science can only be an effective element in the national welfare as a member of a team, whether the condition be peace or war.
>
> As citizens, as good citizens, we therefore think that we must have in mind while examining the question before us—the discovery and development of scientific talent—the needs of the whole national welfare. We could not suggest to you a program which would syphon into science and technology a disproportionately large share of the Nation's highest abilities, without doing harm to the Nation, nor, indeed, without crippling science. The very fruits of science become available

[1] See Vannevar Bush. *Science: the endless frontier.* Washington, D. C. 1945. Pp. 135 f.

only through enterprise, industry and wisdom on the part of others as well as scientists. Science cannot live by and unto itself alone. . . .

The uses to which high ability in youth can be put are various and, to a large extent, are determined by social pressures and rewards. When aided by selective devices for picking out scientifically talented youth, it is clear that large sums of money for scholarships and fellowships and monetary and other rewards in disproportionate amounts might draw into science too large a percentage of the Nation's high ability, with a result highly detrimental to the Nation and to science. Plans for the discovery and development of scientific talent must be related to the other needs of society for high ability: science, in the words of the man in the street, must not, and must not try to, hog it all. This is our deep conviction, and therefore the plans that we shall propose herein will endeavor to relate the needs of the Nation for science to the needs of the Nation for high-grade trained minds in other fields. There is never enough ability at high levels to satisfy all the needs of the Nation; we would not seek to draw into science any more of it than science's proportionate share.

And we further said:

As emphasized, this report is concerned with discovering and developing scientific talent, but in its proper setting and relationship to other needs for talent for the Nation's welfare. In the report we shall suggest, as befits our mandate, the appropriation of Federal funds to be applied only to the purpose of discovering and developing scientific talent; but, as we have pointed out, we recognize that there is need for the discovery and development of talent in all lines and we point out that most of the plans and procedures recommended herein for science are equally applicable to the discovery and development of talent in other fields.

Some of you will now be thinking: "Just why does he think he has to drag this social science controversy in? Doesn't he know that he is supposed to be writing about the importance of the problem of the shortage of *scientific* personnel?" To those I say, if you lessen a shortage by taking material from a field where the supply is limited, you necessarily affect others' needs for that material. If others' needs for that material significantly affect your own operations, you would be unwise to lessen your own shortage by increasing theirs. In the context of this paper, it is clear to me that our problem of lessening our scientific shortages is bigger than the particular problem, and that is why I consider a discussion of the needs for high ability in fields other than science to be germane to my topic.

For our observations on this subject—those quoted above from the Bush Report—we were at first let off scotfree. But when the President, in his message recommending science legislation, added five words, "and in the social sciences," we were told by some scientists that we, or somebody, had very much gummed the works.[2] I have no way of knowing how you, or a majority or a minority of you, stand on this proposition, but I should like to state two truths which ought to convince you, I think, that the President was right in including the social sciences in his proposed science legislation—at least in so far as the need for discovery and development of talent in American youth is concerned.

First, science is not properly a game, played by its participants for their own benefit and satisfaction. Science, like anything else paid for out of the public's purse, is justifiable only in so far as it results, as a long-term proposition, in a more full and fruitful life to the people at large by the improvement of standards and satisfactions of living, by the creation of new enterprises, by bringing in new jobs, etc. But these results are not merely matters for science; they are also in very important ways matters of economic organization, of systems of taxation, of fair public administration, of resistance to pressure groups, and of many other social science factors. We shall not get the benefits of science in the best manner in our national life unless really scientific studies are developed in connection with many broad economic, social, and political items in our national organization. For these studies we need to develop more and better social thinkers than we now have. Not only do we as a nation need them, but the world also needs them; and science as socially useful science needs them. Without these studies, free science is going to be something your successors may read about but will not have.

Moreover, as we increase the tempo of scientific advance, the more shall we need to better the quality of thought over the whole spectrum of the human mind and spirit. For this reason I devoutly hope that, if support for scientific training comes from government, and no governmental support goes to other training, funds now used for science training will be driven into other fields.

Secondly, there is a very elementary and self-evident reason for not restricting to the sciences a program for the discovery and development of talent in American youth. The reason is that in youth—at the end of high school, for example—it is too early to say whether or not a boy or girl should be committed to a career in science and be given a scientific education. It is true that certain tests can be given to youth which show with some degree of accuracy whether or not they are oriented toward scientific pursuits, but it is also true that those same tests point to success in fields other than science. Science for the Nation's good or for its own good, should not try to grab too large a share of the available brains.

Some may think that the foregoing statements lead to the logical conclusion that all high ability should be included in the talent search and its development and that potential literary critics, poets, composers, painters, theologians, and all those who can profit from higher training should be included. I think that this is the case, for I agree with Dr. Raymond Fosdick, president of

[2] For such a view, see Paragraph 8 in the letter to President Truman from the Committee Supporting the Bush Report (*Science*, 1945, **102**, 546).

The Rockefeller Foundation, who said recently: "Certainly in our search for the means to control our own fate we must not overlook the possibility that the unity of mankind may be achieved by art or music, a poem or or song, perhaps more effectively and lastingly than by engineering, medicine, or economics."

The point of view that poets, painters, composers, humanists, and social scientists have as strong claims to support as scientists in any plan for the development of those who will lead mankind is the point of view of the John Simon Guggenheim Memorial Foundation, and for more than 20 years we have made our appropriations in that belief.

But, having said this with respect to the Foundation's funds, I shall go on to say that while I hope I am pure—in a mathematician's use of that word—I also hope I am not too pure and that I am not so politically simple, where the question is on the use of government funds, as to insist upon ultimates or end-of-the-road conclusions.

Time brings many innovations, as the founders of early state and other universities would see if they could see now the present breadth and inclusiveness of their institutions. They might not be content with what they would see; but, as for myself, I should be content to wait for many logically foreseeable developments and not be distressed if they did not work out according to my or anybody else's logic. "The life of the law," Mr. Justice Holmes said, "has not been logic: it has been experience." Likewise, experience ought to govern here. He went on to say: "The felt necessities of the time, the prevalent moral and political theories, intuitions of public policy, avowed or unconscious, even the prejudices which judges share with their fellow men, have had a good deal more to do than the syllogism in determining the rules by which men should be governed . . . ."[3]

In this constitutional republic it cannot be otherwise, and it should not be otherwise. Whatever scientists may think of the importance of the problem of the shortage of scientific personnel, they will get no amelioration of it by government unless and until amelioration is one of "the felt necessities of the time." If we get it, we shall get it only in accordance with "the prevalent moral and political theories" of this country at the time of legislative enactment, in accordance with "intuitions of public policy" and in accordance with the prejudices which members of Congress share with their fellow men. Those prejudices—and neither Mr. Holmes nor I are using the word invidiously but in its primary sense—will not now permit poets to be educated by Federal funds; but I hope and believe that in any science legislation the wisdom of the Congress, which I believe in, will demand the development of social science concomitantly with the natural sciences. If not, you or your successors will some day wish the Congress had.

John Stuart Mill, in *On liberty*, has written my conclusion: "The worth of a State, in the long run, is the worth of the individuals composing it; and a State which postpones the interests of *their* mental expansion and elevation, to a little more of administrative skill, or that semblance of it which practice gives, in the details of business; a State which dwarfs its men, in order that they may be more docile instruments in its hands even for beneficial purposes, will find that with small men no really great thing can be accomplished . . . ."

[3] From O. W. Holmes, Jr. *The common law*. Boston, 1881. Pp. 1, 2.

**The organization meeting of the new Inter-Society Committee on Science Foundation Legislation will be held at Hotel 2400, 2400 16th Street, N.W., Washington, D. C., on February 23, beginning at 10:00 A.M.**

**Almost 100 delegates are expected to take part in the day-long discussion under the leadership of Kirtley F. Mather, who has made the preliminary arrangements for the meeting and who is chairman of a Council committee which called the organizational meeting of the new group.**

**The delegates are to be guests of Science Service for luncheon. It is expected that the occasion will provide an opportunity for scientists to meet with the principal backers of science legislation on Sunday evening.**

# First Report of the U. S. Atomic Energy Commission

**David E. Lilienthal, *Chairman*; Robert F. Bacher, Sumner T. Pike, Lewis L. Strauss, and William W. Waymack**

THE FOLLOWING REPORT IS RESPECTfully submitted pursuant to the direction of Section 17 of the Atomic Energy Act of 1946 which provides that "The Commission shall submit to the Congress, in January and July of each year, a report concerning the activities of the Commission."

The Atomic Energy Act was approved on August 1, 1946. On October 28, 1946, while the Senate was in recess, the President named the present members of the Commission [see *Science*, November 8 and December 13]. The members of the Commission required some time to sever their existing business and employment connections in order to comply with the requirement of Section 2(a)(2) of the Act that "No Member of the Commission shall engage in any other business, vocation, or employment than that of serving as a member of the Commission."

On November 13, the Commission held its first meeting, and since that time its members have devoted their entire time to the business of the Commission. Because of the magnitude and complexity of the undertakings and responsibilities vested in the Commission by the Act, and because of the necessity of uninterrrupted activity, the War Department consented to continue operation of the enterprise—known as the Manhattan Engineer District of the Corps of Engineers—until a transfer to the Commission could be effected without risk of interruption consequent upon the change from military direction by the War Department to operation by the newly-constituted statutory Commission. At midnight on December 31, 1946, this transfer became effective, by virtue of Executive Order 9816 [see *Science*, January 10]. The Executive Order was issued pursuant to the directions of the Congress contained in Section 9(a) and other provisions of the Act.

The relative brevity and lack of detail in this initial report of the Commission is explained by the fact that the Commission has been in responsible control of this very large undertaking for only about four weeks, and but two and a half months have elapsed since its first meeting. In its next semiannual report to the Congress, due in July of this year, it is the intention of the Commission to submit a comprehensive statement (within the limitations that the maintenance of security of information makes feasible in a public report). Prior to to that time the Commission will report, orally and in writing, to the Joint Committee on Atomic Energy, in accordance with Section 15 of the act, which provides that "The Commission shall keep the joint committee fully and currently informed with respect to the Commission's activities."

As promptly as possible the Commission will report to the Joint Committee the present status of the work of the Commission, the status of properties, facilities, contracts, personnel, financial condition and other similar facts, and plans for future development as those plans proceed. The Commission also will keep the Joint Committee fully and currently informed concerning the program of administration consistent with the policies of the Act (Section 1(b)(5)) and other policy determinations, among which some of the most important relate to methods of maintaining secure the information which must be kept secret in the interest of national safety.

*Inspection of Manhattan District.* The members of the Commission determined that their first step should be a survey of the facilities of Manhattan District. Accordingly on November 12, accompanied by Colonel Kenneth D. Nichols, the District Engineer, the Commission left Washington for Oak Ridge, Tennessee, administrative center and principal installation of Manhattan District. In the ensuing two weeks the Commission visited a number of major installations, making brief inspections and holding conferences with key executive and scientific personnel of Manhattan District and its contractors.

*Transfer of Manhattan District.* On October 26, the day President Truman named the members of the Commission, all five members conferred with the Secretary of War, General Eisenhower, and General Groves. Secretary Patterson offered the full cooperation of the War Department in the Commission's work and agreed to continue the Manhattan District operations under War Department jurisdiction until the members of the Commission could organize formally and acquaint themselves with the project. At the same time Secretary Patterson urged that the properties and functions then under the jurisdiction of Manhattan District, and required by the Act to be transferred, should be placed under Commission jurisdiction at the earliest possible date, and that as soon as possible military personnel should be released.

As already indicated, following the first formal meeting on November 13, all the members of the Commission spent the next two weeks visiting major installations of Manhattan District, consulting with key personnel of the District and its contractors, and studying the work and the problems of the project. As soon as these activities had proceeded far enough to afford a general familiarity with Manhattan District, its personnel and installations, the Commission took up the problem of bringing about the transfer of the project as contemplated by Section 9(a) of the Act [see *Science*, December 20].

The numerous details involved in the transfer of the properties, funds, personnel, and contracts were worked out during the month of December. During that month a large part of the time of the Commission was devoted to these matters.

At that time Manhattan District had more than 5,000 direct employees, military and civilian. The contractors for the District who were operating its installations had more than 50,000 employees in that work. A major problem that had to be solved related to the fiscal and disbursing arrangements necessary to avoid any interruption in work when the transfer occurred. In cooperation with the War Department, the Department of the Treasury, the Bureau of the Budget, and the General Accounting Office, arrangements were made for the allocation of appropriations to the Commission under Public Law 663, and fiscal and disbursing procedures were established to assure continuity in operations. Through consultation with the War Department, the Department of the Navy, and the Military Liaison Committee, arrangements were perfected to make certain that those operations and functions essentially military in character should remain under military jurisdiction.

Arrangements also had to be made for the retention of military personnel in actual Commission operations during the transition period; procedures had to be worked out in consultation with the Federal Bureau of Investigation with a view to obtaining the FBI investigations required by Section 10 of the Act at the earliest feasible date; and numerous other matters connected with the transfer, and in which other government agencies were concerned in one way or another, had to be dealt with.

It is a measure of the cooperative spirit in which all these problems were approached by the various government agencies that the Executive Order and other formal documents covering the transfer were executed and the actual transfer completed on January 1, on a mutually satisfactory basis and without any interruption in continuity of operations.

*Government-owned Facilities.* The principal government-owned atomic energy installations transferred from Manhattan District and now under the jurisdiction of the Commission are:

1. Clinton Engineer Works, Oak Ridge, Tennessee, a 59,000-acre reservation, the site of the Manhattan District administrative headquarters, and of the following production and research units:

a. Electro-Magnetic Plant for the separation of U-235, operated by Tennessee Eastman Corporation.

b. Gaseous Diffusion Plant for the separation of U-235, operated by Carbide and Carbon Chemicals Corporation.

c. Thermal Diffusion Plant for the separation of U-235, not in operation.

d. Clinton Laboratories for general nuclear research, operated by Monsanto Chemical Company.

2. Hanford Engineer Works, Pasco, Washington, a reservation of nearly 400,000 acres owned or controlled by the Government, site of plutonium production plants and of research and development facilities, now operated by General Electric Company [see *Science*, November 1].

3. Los Alamos Laboratory, at Los Alamos, New Mexico, a 45,000-acre reservation, site of a research installation principally for the military applications of atomic energy, and operated under contract with the University of California.

4. Argonne National Laboratory at Chicago, Illinois, successor to the Metallurgical Laboratory, now housed in part on the campus of the University of Chicago, which is contractor for administration. The board of governors for this laboratory is composed of representatives of 25 midwestern universities and research institutions.

5. Radiation Laboratory of the University of California at Berkeley (not a government-owned facility—except for certain buildings and equipment).

6. Brookhaven National Laboratory, Patchogue, Long Island, now under construction on the site of Camp Upton, a general atomic research center to be operated by Associated Universities, Inc., representing nine major Eastern universities with the collaboration of other colleges and universities in the region.

7. Knolls Atomic Power Laboratory, Schenectady, New York, a research center for development of useful power from atomic energy, now under construction and to be operated by General Electric Company. Under arrangements made by the Commission, provision has been made for participation of interested segments of the national economy.

The Commission plans immediately to consult with representatives of interested American industries in such fields as utilities, electrical manufacturing, chemicals and others, in order to assure broad participation by private enterprise in its research and development program, looking toward the industrial applications of atomic energy.

8. Dayton Engineer Works near Miamisburg, Ohio, a research and development facility now under construction and to be operated by Monsanto Chemical Company.

In addition, activities contributing directly to the operations transferred to the Commission are carried on in a large number of other facilities. A partial list of the extensive research and development contracts includes those held by Battelle Memorial Institute, Columbus, Ohio; Columbia University, New York; Iowa State College, Ames, Iowa; Massachusetts Institute of Technology, Cambridge, Massachusetts; National Bureau of Standards, Washington, D. C.; United States Geological Survey, Washington, D. C.; University of Rochester, Rochester, New York; University of Washington, Seattle, Washington; Victoreen Instrument Company, Chicago, Illinois; and Washington University, St. Louis, Missouri.

*Major Programs in Effect.* The following principal programs, which had been initiated by Manhattan District, were transferred to the Commission:

1. The production of fissionable materials.

2. The declassification of atomic energy data, to the extent consistent with security, carried out on the basis of recommendations of a committee headed by Dr. Richard C. Tolman.

3. The production and distribution of radioactive isotopes, started by Manhattan District during the summer of 1946 [see *Science*, June 14]. Upon recommendations of an advisory committee appointed by General Groves, radioactive isotopes have been distributed to qualified institutions capable of observing the necessary health and safety precautions.

4. A broad program for the production of electric power from nuclear fuels, initiated by Manhattan District, with Monsanto Chemical Company and General Electric Company as prime contractors. A large number of industrial and research organizations are participating in this program, and a summary review of the status of the work was recently published by Manhattan District.

5. Studies of the possibility of applying nuclear energy to aircraft propulsion, being made under contract between the Army Air Forces and Fairchild Engine and Airplane Corporation as prime contractor. Through arrangements made with Manhattan District, space and technical services have been made available at Oak Ridge for the staff assigned to these studies by the Air Forces and the contractors.

6. A comprehensive accident prevention and health program, in effect throughout all facilities. Care has been taken to safeguard personnel against injury from radiation exposure and other hazards, and reports indicate that the program has been effective.

7. Broad research programs in the fields of health and biology under way at Argonne National Laboratory, Los Alamos Laboratory, and at Clinton Engineer Works, in cooperation with the U. S. Institute of Public Health.

8. Training programs for the instruction of personnel in the handling of radioactive materials, in effect at Argonne National Laboratory, the Radiation Laboratory, and Clinton Laboratories.

9. The compilation of scientific developments resulting from the work of Manhattan District.

10. Research programs too numerous to list, many of which are classified secret, under way in both government and nongovernment facilities. These programs include the physics of reactors, development of materials for construction of reactors, metallurgy, radioactive isotopes, production processes, fundamental nuclear physics, ceramics, radiobiology, various types of instruments, and health measures.

*Development of Organization.* The Commission took steps to maintain as a going concern the organization transferred from Manhattan District. Colonel K. D. Nichols, District Engineer, was appointed Acting Deputy General Manager of the Commission. Colonel Nichols and all other personnel transferred from Manhattan District were instructed by the Commission to continue to perform their functions in the manner in which they had performed them under Manhattan District. The Commission thus made certain at the outset that there should be no interruption or loss of continuity in operations. At the request of the Commission, General Groves has consented to act as a consultant to the Commission.

The Act provides for the appointment by the President from civilian life of nine members of a General Advisory Committee to advise the Commission on scientific and technical matters relating to materials, production, and research and development. The President had appointed the following members of the General Advisory Committee on December 12, 1946: Dr. James B. Conant, President of Harvard University; Dr. Lee A. DuBridge, President of California Institute of Technology; Prof. Enrico Fermi, University of Chicago; Dr. J. Robert Oppenheimer, University of California; Prof. I. I. Rabi, Columbia University; Mr. Hartley Rowe, Chief Engineer of United Fruit Company; Prof. Glenn T. Seaborg, University of California; Prof. Cyril S. Smith, University of Chicago; and Mr. Hood Worthington, Chief Chemist of E. I. du Pont de Nemours & Company [see *Science*, December 20]. At the request of the Chairman of the Commission, the General Advisory Committee held its first meeting on January 3 and 4, 1947, for the purpose or organizing its work and determining the methods whereby it might assist and advise the Commission. The Committee designated Dr. J. Robert Oppenheimer as Chairman. The Commission has arranged to furnish for review by the General Advisory Committee a statement of the Commission's research and development, production, and materials programs. A report on research and development programs will be available for the next meeting of the Committee, February 2 and 3, 1947. Subsequent meetings of the General Advisory Committee are now planned at two-month intervals.

Before making a recommendation to the President, pursuant to Section 2 (a) (4) (A) of the Act, with respect to the appointment of a General Manager, the Commission sought the advice of the following advisory group: Karl T. Compton, President, Massachusetts Institute of Technology; Herbert Emmerich, Director of Public Administration Clearing House; Georges Doriot, Professor, Harvard School of Business; and John Lord O'Brian, Attorney (former General Counsel, War Production Board). After a review of the qualifications of a large number of individuals, this group submitted the names of several individuals, including Carroll L. Wilson, whom the group considered to be exceptionally qualified for this position. After careful consideration of these men, the Commission unanimously recommended to the President the appointment of Mr. Wilson. The President named Mr. Wilson as General Manager on December 30, 1946 [see *Science*, January 10].

A great deal of careful consideration has been given to the form of organization best adapted to suit the purposes of the Commission and, in particular, to the functions of the four divisions of research, military application, production, and engineering provided for by Section 2(a)(4)(B) of the Act. The Commission has concluded that these four divisions should be staff divisions responsible for planning, review, and evaluation of the work of the Commission under these broad functional categories.

Under this concept of organization, the Division of Military Application assumes a far more important position in relation to the entire program of the Commission than would be the case if it were merely a line operating division concerned with direct supervision of such portions of the Commission's operations as might be identified as primarily relating to military applications. The Division of Military Application will be concerned with the broad and complicated interrelationships between military planning and the research, development, and production programs of the Commission.

In view of the great responsibilities placed upon the Commission by the Act, that its operation shall be conducted always with the paramount objective of assuring the common defense and security, the Commission has given most careful consideration to the essential qualifications for the officer who shall be the Director of the Division of Military Application. The Commission has discussed its views of the qualifications for such officer with the Secretaries of War and the Navy and have asked them to submit the names of the best qualified officers in their respective services. The Commission has under consideration a small group of exceptionally qualified officers who have been so recommended, and expects to make the appointment in the near future.

As Director of the Division of Research, the Commission has appointed Dr. James B. Fisk, formerly Assistant Director of Physical Research at the Bell Telephone Laboratories and recently appointed Professor of Applied Physics at Harvard University [see *Science*, February 14]. Dr. Fisk was recommended to the Commission by a subcommittee of the General Advisory Committee, appointed for the specific purpose of making recommendations for this position.

As Director of the Division of Production, the Commission has appointed Mr. Walter J. Williams, former Director of Operations at Oak Ridge for Manhattan District and recently appointed Manager of Field Operations of the Commission.

The appointment of the Director of the Division of Engineering will be announced later by the Commission. A five-man advisory panel, recommended by the General Advisory Committee, has been requested to make recommendations for this position.

The Commission has made appointments to some other key staff positions. These include the Director of Organization and Personnel, Mr. G. Lyle Belsley, who was formerly Assistant Administrator of the National Housing Agency and Executive Secretary of the War Production Board; and the General Counsel, Mr. Herbert S. Marks, who was formerly Special Assistant to Under Secretary of State Dean Acheson.

*The Military Liaison Committee.* Pursuant to Section 2(c) of the Act, the Secretary of War and the Secretary of the Navy have designated the following representatives of their departments as members of the Military Liaison Committee: Lieutenant General Lewis H. Brereton, USA, Chairman; Major General Lunsford E. Oliver, USA; Colonel John H. Hinds, USA; Rear Admiral Thorvald A. Solberg, USN; Rear Admiral Ralph A. Ofstie, USN; and Rear Admiral William S. Parsons, USN.

Informal contact between members of the Commission and the Military Liaison Committee was established prior to the Commission's first meeting. Since the Commission's inspection tour of the Manhattan District installations, the Commission has met with the Military Liaison Committee, and there have been frequent contacts between the staff of the Commission and the Committee. Discussions have centered around problems of organization, procedure, the development of close liaison and working relationships. The Committee was consulted in the preparation of the various papers and in the working out of the various arrangements covering the transfer of the Manhattan District to the Commission. Matters now under joint consideration by the Commission and the Military Liaison Committee include production of fissionable materials, security problems, research programs, relations with the General Advisory Committee, and relations with the Joint Research and Development Board, which is under the chairmanship of Dr. Vannevar Bush [see *Science*, January 24].

*Maintenance of Security.* The Commission has maintained in full force the security measures of Manhattan District and has under consideration the adequacy of those measures in terms of the requirements of national defense and of the Act.

The Commission has met with the Attorney General and with the Federal Bureau of Investigation for the purpose of establishing procedures for the investigation of personnel and of security violations.

The Commission has been able to obtain the services of Mr. Frank J. Wilson, Chief of Secret Service until December 31, 1946, as consultant on security policies and problems.

The Commission also has obtained the services of Mr. Thomas O. Jones as Special Assistant for Security to the General Manager. Mr. Jones was formerly an officer assigned to the Manhattan District. He served as security officer at the Los Alamos installation and was designated by General Groves as the security officer at the Bikini tests.

*Production of Fissionable Materials and Atomic Weapons.* The production operations which Manhattan District had under way at the time of the transfer are being continued. Much of the information relating to the production of fissionable materials and atomic weapons vitally concerns the common defense and security. This information received the highest security classification by Manhattan District and that classification has been continued by the Commission.

The primary application of atomic energy is today

in the production of weapons. These weapons require fissionable material of considerable purity and this requirement was the main reason for the construction of the installations at Oak Ridge and Hanford. Fissionable material also is necessary for the development of many of the peacetime applications of atomic energy. In addition, the basic raw material, uranium, is the same either for weapon production or for the peacetime applications. There is accordingly a very deep and basic relation between weapons and the peacetime uses of atomic energy. The long-range security of the Nation may very well depend closely upon the wise and speedy development of the applications of atomic energy. Research and development work on improved atomic weapons is in progress at installations now operated by the Commission.

In December General Groves informed the Commission that improvements in the processes for the separation of Uranium 235 at Oak Ridge would permit considerable savings in operating costs and result in substantial reduction in the number of employees required at one of the Oak Ridge plants. After careful study of a report from Colonel Nichols, the District Engineer, the Commission concurred in the necessary operating changes. Every effort is being made by the Commission to assure the retention of key personnel whose jobs have been discontinued as a result of the operating change.

*Research and Development Programs.* A comprehensive report on the status of research and development programs was initiated by the Commission. For this purpose the Commission called a meeting in January of laboratory directors, representing Argonne National Laboratory, Brookhaven National Laboratory, the University of California, Clinton Laboratories, General Electric Company, Iowa State University, and Los Alamos Laboratory. The reports prepared by these laboratory directors will furnish a basis for recommendations by the Director of the Division of Research and by the General Advisory Committee and will enable the Commission to plan and evaluate research and development projects. Meanwhile, a number of specific administrative decisions have been made by the Commission in order to assure continuance of programs initiated by Manhattan District pending thorough review by the Commission.

*Source Materials.* The Commission has under consideration a plan for the control of source materials, as provided by the Act. Meanwhile, the wartime control over uranium exercised by the War Production Board is being continued by the Office of Temporary Controls.

An important phase of the Commission's programs will be the development of new sources of uranium and and thorium. The Commission has met with Secretary Krug and other representatives of the Department of the Interior for the purpose of considering how best the services of the U. S. Geological Survey may continue to be employed in this field and for the purpose of discussing other ways in which the Department of the Interior and the Commission might cooperate.

*Health and Medical Program.* A medical committee, under the chairmanship of Dr. Stafford L. Warren, was appointed by General Groves to advise Manhattan District on health and medical problems. The committee consisted of representatives of laboratories and other installations holding contracts with Manhattan District. The Commission called a meeting of this medical committee in January with a view to the preparation of a report on the status of health and medical programs. It is expected that a report will be available to the Commission shortly.

*Labor Relations.* During the interval between V-J Day and transfer of the activities of Manhattan District to the Commission, elections were held by the employees of the principal contractors at Oak Ridge. The employees of Carbide and Carbon Chemical Corporation are now represented by a CIO union and the employees of Monsanto Chemical Company by an AF of L affiliate. Labor contracts, negotiated by these companies and their respective unions, had been presented to Manhattan District for approval. At the request of the Commission, the contracts were examined by an advisory board consisting of David A. Morse, Assistant Secretary of Labor, George H. Taylor, former Chairman of the War Labor Board and a member of the faculty of the Wharton School, University of Pennsylvania, and Lloyd K. Garrison, former General Counsel and later Chairman of the War Labor Board [see *Science*, January 10]. Pursuant to the recommendations of this advisory board, the Commission approved execution of the contracts subject to further consideration of those clauses affecting security and continuity of work.

*Patents.* The Commission has appointed Casper W. Ooms, Commissioner of Patents, William H. Davis, Chairman of the Department of Commerce Patent Survey Committee, and John A. Diener, former President of American Patent Law Association, as an advisory panel to recommend to the Commission policies, procedures, and staff organization for the effectuation of the patent provisions of the Act (Section 11). Following a report and recommendations by this advisory panel, the Commission expects to appoint a Patent Compensation Board as required by the Act and to institute appropriate patent regulations and procedures.

*Budget and Fiscal Program.* The Commission has submitted to the House Appropriations Committee a full statement of the transfer to the Commission of War Department funds for the Manhattan Project and a budget justification of appropriation requests for the fiscal year 1948. Pursuant to Public Law 663, the President has withdrawn $506,000,000 from the War Department accounts for the Manhattan Project, of which $5,000,000 has been allocated to the Federal Bureau of Investigation and the balance to the Commission. Of the $501,000,000

allocated to the Commission, $263,991,000 was immediately obligated to cover contract and other obligations transferred to the Commission.

The President's budget for the fiscal year 1948 includes $250,000,000 for Commission expenditures and $250,000,000 for Commission contract authorizations. In estimating its requirements, the Commission has necessarily, because of the short time available, relied largely on the experience and estimates of Manhattan District. The Commission is proceeding with the development of its own financial and budgetary plans and estimates as a matter of primary importance. In its next report it will be in a position, therefore, to discuss these matters more fully.

*Accounting Control.* One of the important problems confronting the Commission relates to the setting up of measures of accounting control that will be consistent with the requirements of a government undertaking and at the same time adapted to the special character of the Commission's enterprises. Because of the novelty and difficulty of many of the questions involved, the Commission has sought the advice of leading experts in this field with respect to the choice of a controller. The following panel was established to advise the Commission in this matter: Mr. Edward B. Wilcox, Partner, Edward Gore & Company (Chicago), and President, American Institute of Accounts; Mr. Walter L. Schaffer, Partner, Lybrand, Ross Bros. & Montgomery (New York); Mr. Paul Grady, Partner, Price, Waterhouse & Company (New York); Mr. Donald Stone, Assistant Director in charge of Administrative Management, Bureau of the Budget; and Prof. W. Arnold Hosmer, Professor of Accounting, Harvard Graduate School of Business Administration.

This group has met with the entire Commission and the General Manager, and has held a number of meetings with the Commission's staff. It is expected that as a result of the work of this group the Commission will shortly be in a position to appoint a controller and to initiate the work that needs to be done in order to set up a constructive system of accounting controls.

*Relations to Work of United Nations Atomic Energy Commission.* On October 28, 1946, the day the President named the members of the Commission, the Commission called upon the Secretary of State, Mr. Byrnes, and Under Secretary Acheson, to discuss in a preliminary way the relations of the Commission to the responsibilities of the State Department, and to establish liaison.

On October 30 the Chairman of the Commission called upon Mr. Bernard Baruch and his associates of the American delegation to the United Nations Atomic Energy Commission at their office in New York City. On behalf of the Commission Mr. Lilienthal stated the Commission's desire to cooperate with Mr. Baruch in whatever ways might appear helpful to him in his great responsibility. Informal liaison was established through the services of Joseph Volpe, Jr., formerly consultant to Mr. Baruch and now a Deputy General Counsel of the Commission, and technical liaison was established through Dr. R. C. Tolman, head of the American Delegation's Technical Advisory Committee. A number of informal communications and consultations have followed. The Commission has assured Senator Warren R. Austin, Mr. Baruch's successor as American Representative, of its desire to cooperate with him in whatever ways he finds may be helpful.

*Legislation.* Section 17 of the Act which directs the Commission to submit to the Congress, in January and July of each year, a report concerning the activities of the Commission, also provides that "The Commission shall include in such report, and shall at such other times as it deems desirable submit to the Congress, such recommendations for additional legislation as the Commission deems necessary or desirable."

The Manhattan District operated during its existence largely upon the wartime powers of the President. A comprehensive review of the arrangements made under these wartime powers is currently under way in order to fit them into a pattern for peacetime operation under the Act. The Commission has not yet had an opportunity to determine whether additional legislation is required.

# NEWS *and Notes*

**UNRRA** brought its health program in Europe to a close January 1, with the exception of Displaced Persons Camps, and will conclude operations in China March 31. With financial assistance of $1,500,000 from UNRRA the Interim Commission of the new World Health Organization, with headquarters in New York City, will bridge the gap until WHO is fully established about a year from now.

UNRRA made these statements recently, in summing up its health activities. UNRRA expenditures for health work in 1946 were 100 times as great as the largest annual budget of the League of Nations health organization and about 25 times as great as the 1947 budget for WHO. As the largest international health organization the world has ever seen, UNRRA's accomplishments fall in four general classifications:

(1) Europe has had no major epidemics since the war. This has been largely due to immediate and effective use of modern drugs and insecticides such as penicillin, the sulfas, and DDT. By the end of 1946, UNRRA had delivered 125,000 tons of medical supplies, and an estimated 80,000 tons are still in the pipelines.

(2) UNRRA has given medical service to displaced populations. About 5,000,000 people have been dusted with DDT to prevent typhus. Once the camp populations became somewhat stable, care included immunization against typhus, diphtheria, typhoid, and smallpox; X-rays; dental and eye clinic care; and pre- and postnatal care.

(3) UNRRA made available to health departments of 17 countries the advice and assistance of nearly 1,200 doctors, nurses, sanitary engineers, epidemiologists, nutritionists, etc.

(4) The organization has been an international clearinghouse for information, particularly about communicable diseases.

## About People

**Leonard B. Loeb,** professor of physics, University of California, Berkeley, will deliver the 38th annual Kelvin Lecture before the Institution of Electrical Engineers, London, April 24. The lecture, given on invitation, will be "Electrical Discharge Through Gases," a subject on which Prof. Loeb has conducted research for 30 years. Prof. Loeb is the second American chosen for the lectureship, established in 1908.

**Karl T. Compton,** president of Massachusetts Institute of Technology, will receive the 1947 Washington Award granted by the Western Society of Engineers and its four founder societies in Chicago, February 26. The award, founded in 1916, recognizes each year an "engineer who has distinguished himself in his profession and whose activities have contributed conspicuously to human progress." Dr. Compton will be cited for notable contributions to scientific and engineering education and research, as well as for service in public and private technical organizations.

**Robert R. Wilson,** now engaged in development of the new Harvard University cyclotron, has been appointed professor of physics at Cornell University. He will also serve as director of the new Laboratory of Nuclear Studies, in the absence of Robert F. Bacher, who is on leave with the Atomic Energy Commission until 1952. Dr. Wilson was in charge of experimental work of the Princeton branch of the atomic energy project during 1941–43 and was head of the Division of Experimental Physics, Los Alamos Laboratory, Manhattan Project. He became instructor in physics at Princeton in 1940, assistant professor in 1942, and was appointed to the Harvard faculty in March 1946.

**Arthur Stoll** was honored by coworkers and friends on his 60th birthday, January 8, for contributions to enzyme chemistry and elucidation of the chemical structure of medicinal agents derived from plants. With Sandoz Chemical Works, Inc., since 1917, Dr. Stoll became director of the laboratories in 1923 and vice-president of the board of directors in 1935. He was born in Switzerland and there began investigations of chlorophyll pigment and enzymes which were to be the basis for future work. In the Sandoz laboratories he prepared sensitive natural agents of value to medicine which resulted in isolation of such drugs as gynergen (ergotamine tartrate), bellafoline (total alkaloids of folia belladonna), scillaren (glycosides of squill), and digilanid (complex of natural lanatosides, A, B, and C). Dr. Stoll has received honors from the University of Basle, University of Berne, Swiss Pharmaceutical Association, the Sorbonne, and others.

**Lise Meitner,** Austrian scientist who went to Sweden as a refugee during the war, will participate in atomic research at Stockholm University under a special grant for the purpose from the Swedish Government. During the past few years she has worked at the institute of Manne Siegbahn, Swedish Nobel Prize winner.

**Sharat K. Roy,** acting chief curator, Department of Geology, Chicago Natural History Museum, and member of the Museum staff since 1925, has been appointed chief curator of the Department. Eugene Richardson, Princeton University, was appointed curator of Invertebrate Fossils.

**Stafford L. Warren,** professor of radiology, University of Rochester School of Medicine and Dentistry, resigned to become dean and professor of biophysics of the new medical school, University of California at Los Angeles, beginning February 1. Dr. Warren was a member of the University of Rochester staff for 21 years except for wartime service as chief of the medical division for the atomic bomb project under the Manhattan District, for which he received the Distinguished Service Medal in 1945.

He will supervise plans for medical school buildings and a university hospital of 500 beds to be built on the campus, and assemble a faculty and staff for the new medical school. The new school, designed for a student body of 300, is not expected to be ready for its first class until 1948 or 1949. Dr. Warren is the fourth man from the University of Rochester to be drafted for administrative posts in colleges and universities in the past year. Lee A. DuBridge, former head of the Rochester physics department, became president of California Institute of Technology; Richard L. Greene, head of the English department, became presi-

dent of Wells College; and Frederick L. Hovde, administrative assistant to Alan Valentine, president, became president of Purdue University.

## Grants and Awards

**The American Society of Photogrammetry** at its annual meeting in Washington last month presented the Sherman M. Fairchild Award for aerial photography, mapping, and charting to Earl F. Church, head, Department of Photogrammetry, Syracuse University.

The Society also presented to Duane Lyon, U. S. Army Aeronautical Chart Service, St. Louis, its Talbert Abrams Award for excellence of two articles written for the Society's journal, *Photogrammetric Engineering*, on use of automatic map-plotting instruments. A life membership and honorary key were presented Thomas P. Pendleton, chief topographic engineer of the Geological Survey, charter member and past president of the Society.

**The University of Rochester** has awarded the $1,200 Pfaudler Fellowship in Chemical Engineering for the current year to Vernon A. Breitenbach, Rochester. Under terms of the grant by the Pfaudler Company, of Rochester, the student must be a master's candidate doing research on agitation and mixing. Applications for the 1947–48 fellowship may be sent to the Dean, Graduate School, University of Rochester, Rochester 3, New York.

**John H. Buchanan,** Chicago, has been awarded the $1,000 Chesterman Award for 1946, first to be made by the American Bottlers of Carbonated Beverages for outstanding work in the soft drink industry. The award was made on the basis of Mr. Buchanan's chemical work with beverage syrups.

**Among the New Year Honors** conferred by the King of England are the following: C.M.G. to P.A. Buxton, professor of entomology, London University, and director, Department of Entomology, London School of Hygiene and Tropical Medicine; Knights Bachelor to W. N. Haworth, director, Department of Chemistry, Birmingham University, C. E. Hercus, professor of bacteriology and preventive medicine, and dean, Medical School, University of Otago, and Kerr Grant, professor of physics, University of Adelaide, South Australia; C.B.E. to F. T. Brooks, professor of botany, Cambridge, T. D. Jones, professor of mining, University of Wales, and T. Wallace, director, Bristol University Agricultural and Horticultural Research Station, Long Ashton.

## Colleges and Universities

**Harvard University Medical School** has announced appointment of James M. Dunning as associate dean of the Faculty of Medicine and dean of the School of Dental Medicine following the resignation of A. LeRoy Johnson. Dr. Dunning after 1938 was president of the Dental Health Service of New York City, during the war was stationed in the Third Naval District as Lieutenant and Lieutenant Commander, and for the past year has been a fellow in public health dentistry, Harvard.

At the same time Robert E. Gross becomes William E. Ladd professor of child surgery; William T. Green, clinical professor of orthopedic surgery; and Joseph S. Barr, clinical professor of orthopedic surgery. Charles A. Janeway has already assumed his new position as Thomas Morgan Rotch professor of pediatrics and head of the Department of Pediatrics, Childrens Hospital.

**The University of Utah School of Medicine** recently received a supplementary grant of $27,750 from the U. S. Public Health Service for further study of muscular dystrophy and other hereditary and degenerative disorders. The Public Health Service last year granted $92,000 for the same purpose.

**Lehigh University's** revision of the civil, mechanical, and industrial engineering curricula, effective next fall, will include changes in course content, introduction of 19 new courses, additional field trips, restoration of a four-week term at the end of the freshman year in land and topographic surveying and machine shop practice, and a required eight weeks of industrial employment between junior and senior years. The changes enumerated in a report of the faculty Educational Policy Committee are aimed to meet changing needs of modern industry.

Six new industrial engineering courses will be introduced in the senior year to provide for advanced study of production control, quality control, product engineering, work simplification, job evaluation, and industrial relations.

New courses in mechanical engineering are airplane structural analysis, stress analysis for design, and experimental methods in aerodynamics. In civil engineering new courses include two in transportation engineering and one each in soil mechanics, hydraulic engineering, hydraulic machinery, readings, route surveying, and reinforced concrete design.

Students will have the choice of three hours each semester during the junior and senior years to take courses in the arts and social sciences, in addition to provision for such courses in the first two years.

**Harvard University** has announced three new Gordon McKay Professorships in the Department of Engineering Sciences and Applied Physics. Leon N. Brillouin, Gordon McKay professor of applied mathematics, had been professor of physics at the University of Paris and the Collège de France and served as general director of the French National Broadcasting System. During the war he was consultant to the Applied Mathematics Panel of Columbia University.

James B. Fisk and Ronold W. P. King have been appointed Gordon McKay professors of applied physics. Prof. Fisk, now director of the Division of Research, Atomic Energy Commission (*Science* February 14), had been assistant director of physical research, Bell Telephone Laboratories. Prof. King was formerly associate professor of physics and communication engineering, Harvard.

**The Research Council on Problems of Alcohol** on January 15 presented to Cornell University Medical College the first of five annual $30,000 checks to finance a five-year, $150,000 research project at the New York Hospital-Cornell Medical Center.

The research, aimed at discovering causes rather than treatment, will be under direction of Oskar Diethelm, professor of psychiatry, Cornell, and psychiatrist-in-chief, The New York Hospital. Patients will be hospitalized in special quarters in the hospital, and research work will be done there and at Cornell by members of the staffs of the two institutions.

According to the Research Council, "This project is in effect a continuation of work which a research team at The

New York Hospital-Cornell Medical Center has been carrying out in the past five years, and is especially important because it means that the resources of a great medical school and hospital are being brought to bear jointly on the overall problem of alcoholism. The Research Council on Problems of Alcohol, an affiliate of AAAS, has now undertaken to furnish sufficient financial support to speed and broaden the work."

## Meetings

**The University of Pittsburgh Department of Psychology** will sponsor a conference, "Current Trends in Psychology," March 5-6, at which recent developments and future trends in seven fields of psychology will be discussed. There will be no charge for attendance, but admission will be by ticket only. Requests may be addressed to the Department of Psychology, University of Pittsburgh, Pittsburgh 13.

Speakers and their respective topics are: Carl Rogers, University of Chicago, psychotherapy; B. F. Skinner, Indiana University, experimental psychology; E. Lowell Kelly, University of Michigan, clinical psychology; Rensis Likert, University of Michigan, psychological surveys; John C. Flanagan, University of Pittsburgh, personnel psychology; Robert Sears, State University of Iowa, child psychology; and Clifford T. Morgan, Johns Hopkins University, human engineering.

**The American Association for the Advancement of Science,** southwestern division, will hold its 23rd annual meeting with the Colorado-Wyoming Academy of Science, at Colorado College, Colorado Springs, May 1-3. Cooperating societies are the Clearing House for Southwestern Museums, Rocky Mountain and Colorado-Wyoming branches of the American Psychological Association, Colorado-Wyoming Social Science Association, and the New Mexico Academy of Science.

Neither membership nor residence within the boundaries of the Association is required for participation. Papers and abstracts should be sent to section chairmen before March 1.

**The 1947 national convention of the Institute of Radio Engineers** will be held in the Hotel Commodore and Grand Central Palace Building, New York, March 3-6. The realm of basic electronic research will be the theme of one of the 20 major sessions, with E. R. Piore, Office of Naval Research, Washington, D. C., reading the leading paper, "Electronic Research Sponsored by the Office of Naval Research." This paper will deal with research in laboratories outside the naval establishment.

Other papers in the basic electronic research group will be delivered by L. Marten, National Bureau of Standards; and K. Bol, Stanford University; C. M. Slack and D. C. Dickson, Westinghouse Electric Corporation; Edward E. Gamble, Polytechnic Institute of Brooklyn; and S. Moskowitz and D. D. Greig, Federal Telecommunication Laboratories.

## Elections

**Phi Sigma Honorary Biological Society,** at a meeting in Boston last December, elected the following national officers: Richard B. Goldschmidt, University of California, honorary national president; A. I. Ortenburger, University of Oklahoma, national secretary; and Karl F. Lagler, University of Michigan, vice-chancellor.

**The Washington Academy of Sciences,** Washington 25, D. C., has elected the following officers for 1947: president, Waldo L. Schmitt; secretary, C. Lewis Gazin; and treasurer, Howard S. Rappleye.

## NRC News

**The Committee on International Cooperation in Anthropology,** under chairmanship of Melville J. Herskovits, has undertaken preparation of a third edition of the *International directory of anthropologists*. The first edition was issued in 1938 and the second in 1940.

The Committee on Latin-American Anthropology, John P. Gillin, chairman, has organized subcommittees: (1) current information, Ralph L. Beals, chairman, to stimulate collection and publication of news regarding Latin-American anthropologists and anthropological research in Latin America; (2) academic relations, Charles Wagley, Jr., chairman, to develop means for coordination and stimulation of staff and student interchanges, and training programs for Latin-American anthropologists; and (3) advisory committee in relation to an undertaking at the University of Chicago for microfilming and distribution of unpublished ethnographic notes of field workers in Middle America, under direction of Sol Tax. These microfilms are available by subscription through the University.

## Make Plans for—

**American Society of Mechanical Engineers,** spring meeting, March 2-5, Tulsa, Oklahoma.

**Western Metal Congress and Exposition,** fifth, March 22-27, Civic Auditoriums, Oakland, California.

**American Association of Anatomists,** annual meeting, April 3-5, Mount Royal Hotel, Montreal, Canada.

**American Geophysical Union,** 28th annual meeting, April 28-30, National Museum, Washington, D. C.

**Society of American Bacteriologists,** annual meeting, May 12-16, Bellevue-Stratford Hotel, Philadelphia Pennsylvania.

**American Association of Cereal Chemists,** 32nd annual meeting, May 19-23, Hotel President, Kansas City, Missouri.

**American Oil Chemists' Society,** 38th annual meeting, May 20-22, New Orleans, Louisiana.

**American Society of Mechanical Engineers,** oil and gas power 19th national conference, May 21-24, Cleveland, Ohio.

**American Society of Mechanical Engineers,** aviation meeting, May 26-29, Los Angeles, California.

**American Society of Mechanical Engineers,** wood industries national conference, June 12-13, Madison, Wisconsin.

**American Society of Mechanical Engineers,** semiannual meeting, June 16-19, Chicago, Illinois.

**American Society for Engineering Education,** 55th annual meeting, June 18-21, University of Minnesota, Minneapolis.

**Chemical Society, London,** centenary meeting, July 15-17, London England.

**International Congress of Pure and Applied Chemistry,** 11th annual, July 17-24, London, England.

**International Physiological Congress,** 17th annual, July 21-25, Oxford, England.

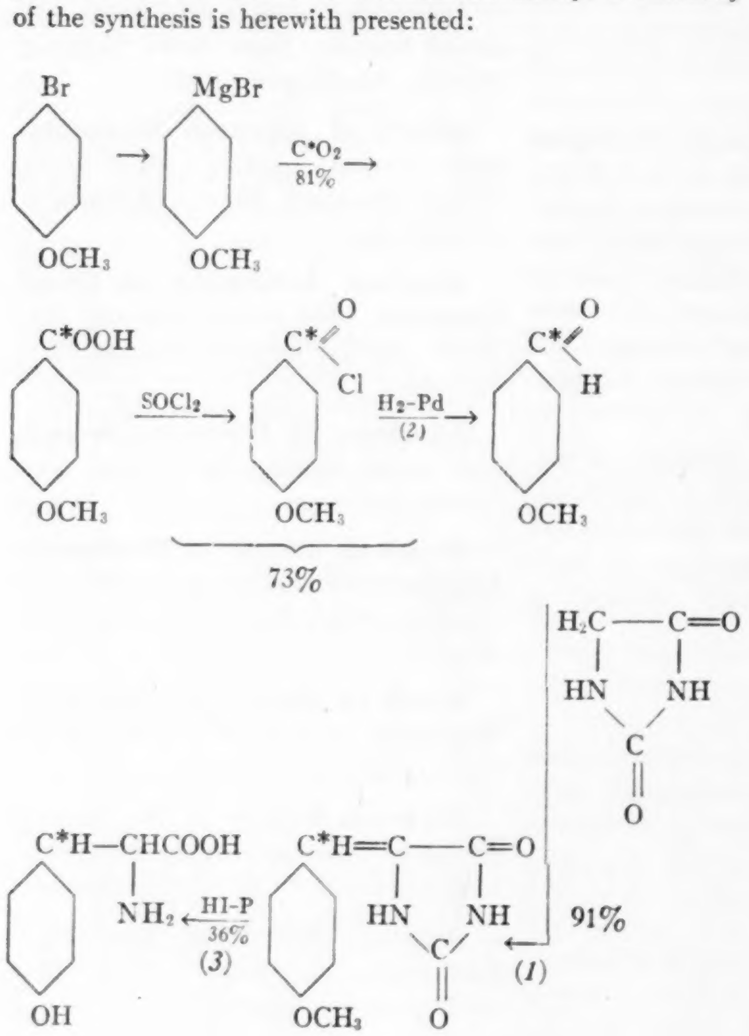
# TECHNICAL PAPERS

## Synthesis of Tyrosine Labeled With $C^{14}$

JAMES C. REID

*Radiation Laboratory, University of California, Berkeley*

The synthesis of dl-tyrosine labeled with $C^{14}$ in the beta position has been carried out in this laboratory. A summary of the synthesis is herewith presented:




The yield was 177 mg. from 1.03 gram of barium carbonate. This is a yield of 19 per cent, based on barium carbonate.

The yield on the last step was less than half that reported by Wheeler and Hofmann. Further work should raise this considerably.

The Grignard carbonation gave yields as high as 89 per cent in trial runs.

The specific activity of the tyrosine was 0.9 microcuries/mg.

### References

1. BOYD, W. J., and ROBSON, W. *Biochem. J.*, 1935, **29**, 545.
2. CASON, J. *Organic syntheses.* (Vol. 21.) New York: John Wiley, 1941. P. 84.
3. WHEELER, H. L., and HOFMANN, C. *Amer. chem. J.*, 1911, **45**, 376.



## Chromatolytic Effect of Cerebrospinal Fluid Following Cerebral Concussion

E. A. SPIEGEL, M. SPIEGEL-ADOLF, and H. T. WYCIS

*Departments of Experimental Neurology* and *Colloid Chemistry, Temple University School of Medicine, Philadelphia*

Following cerebral concussion, the cerebrospinal fluid (CSF) is able to split nucleic acids, as shown spectrophotometrically by a decrease of their selective absorption in ultraviolet light (*1*). This finding was interpreted as due to the appearance of enzymatic substances in the CSF. It seemed of interest to ascertain whether such substances diffusing into the subarachnoid space after concussion are also able to act upon nuclear substances within nerve cells, in particular their tigroid bodies. The CSF's under study were incubated with deparaffinized paraffin sections from normal spinal cords for from 4 to 5 hours at 37° C. and then stained by the Nissl method (preferably with thionine blue). Preliminary experiments showed that on incubation of spinal cord sections with normal CSF or with Ringer's solution, these fluids must be acidified if one wishes to demonstrate Nissl bodies. Therefore, as a rule, 0.05 cc. molar acetate buffer solution with a pH of 4.05 was added to 0.45 cc. cerebrospinal fluid before incubation, so that less than 0.5 cc. CSF is sufficient for this test. While incubation of such acidified normal CSF or Ringer's solution for 4–5 hours at 37° C. with sections of a normal cat's cord leaves most Nissl bodies of the motor cells intact, some CSF's of patients with concussion were able to produce definite tigrolysis (dissolution of the Nissl bodies) in the anterior horn cells under identical conditions. In a parallel study, the effect of these CSF's upon nucleic acids was studied by spectrophotometry in ultraviolet light, and it was found that the CSF's producing tigrolysis were able to decrease markedly the selective absorption of nucleic acids, while those which left the anterior horn cells intact did not affect the nucleic acid samples or only slightly. Thus, the histochemical method and the spectrography confirmed each other.

The demonstration in the CSF of concussed patients of substances able to produce dissolution or a breakdown of Nissl bodies seems of interest for various reasons. From a clinical as well as a medicolegal point of view, the demonstration of changes in the CSF following cerebral concussion may be of value, particularly when other objective signs of damage of nerve cells are scarce or lacking. These findings may also shed some light upon the pathological changes developing in the brain after a blow to the head. If enzymatic substances diffuse from the central nervous system into the CSF, it seems reasonable to suspect that such substances play an important role in the genesis of the chromatolytic changes occurring *in vivo* following concussion.

### Reference

1. SPIEGEL-ADOLF, M., WYCIS, H. T., and SPIEGEL, E. *Fed. Proc.*, 1946, **5**, 156.

# Stimulation of Oleoresin Flow in Pines by a Fungus

George H. Hepting[1]

*Division of Forest Pathology, Bureau of Plant Industry, Soils, and Agricultural Engineering, Asheville, North Carolina*

A species of ***Fusarium*** has recently been found which causes very pitchy cankers on young branches and stems of Virginia pine (*Pinus virginiana* Mill.) and, to a much lesser extent, on those of shortleaf and pitch pines (*P. echinata* Mill. and *P. rigida* Mill.) in the Carolinas (*1*). A few attacks have been noted on the larger trunks of some Virginia pines, and while these trunk attacks have been less severe than those on younger shoots, copious and long-continued gum flow occurred. It seemed conceivable that, since this *Fusarium* so stimulated the flow of oleoresin, it might have application in the naval stores industry, provided the trees are not killed or seriously damaged by the inoculation, provided the widespread use of this organism results in no other unforeseen dangers, and provided the method has commercial advantages. Some preliminary tests have therefore been made of the effect on gum flow of the application to wounds of spore suspensions and filtrates of solutions upon which the fungus grew.

In June 1945, the *Fusarium* was grown on Tochinai liquid medium for a few weeks. The medium was then run through filter paper, which removed the larger mycelial masses but not the spores. One lot of this spore suspension was boiled and one was not. Twelve Virginia pines were then gouged on two sides, in the manner of turpentining streaks, one streak on each tree remaining untreated. The unboiled suspension was added to one streak on each of 8 trees, and the boiled to one streak on each of 4 other trees. During the next year and a half, a continuous pitch flow exuded from the streaks receiving unboiled suspensions, and very little flow, of short duration, exuded from the wounds receiving the boiled suspensions and from those receiving no application.

The 1945 liquid cultures were kept until 1946. On August 6 the cultures were run through filter paper, half of this filtrate then being run through a Jenkins porcelain filter. The following day these solutions were applied to punch holes made through the bark and just to the wood surface of the trunks of four Virginia pines, 7.4–8.2 inches in diameter, breast high; four shortleaf pines, 6.7–8.4 inches; and two longleaf pines, 6.2–6.4 inches, growing on the Bent Creek Experimental Forest near Asheville. Five holes were punched spirally around each tree, the lowest at 1 foot above ground, and the highest at 6 feet. The holes were made with a steel punch, $\frac{3}{8}$ inch in diameter. Small metal aprons were placed under the holes and glass vials under the aprons, to catch the gum, after a method devised by Ostrom and True (*2*). Culture solutions containing active spores were brushed into two of the holes on each tree, culture solutions sterilized by passage through porcelain filters were brushed into two other holes, and the remaining hole on each tree was untreated. The order of treatment was randomized on each tree.

[1] E. R. Roth, Division of Forest Pathology, assisted in the field work, facilities for which were made available through the cooperation of the Southeastern Forest Experiment Station, Asheville.

Fig. 1 shows gum yields for the different species and treatments between August 6 and October 19. All untreated holes and those treated with porcelain-filtered culture solution showed a small initial gum yield during the first few days, after which the flow ceased. The holes treated with solutions containing viable spores have shown marked stimulation of

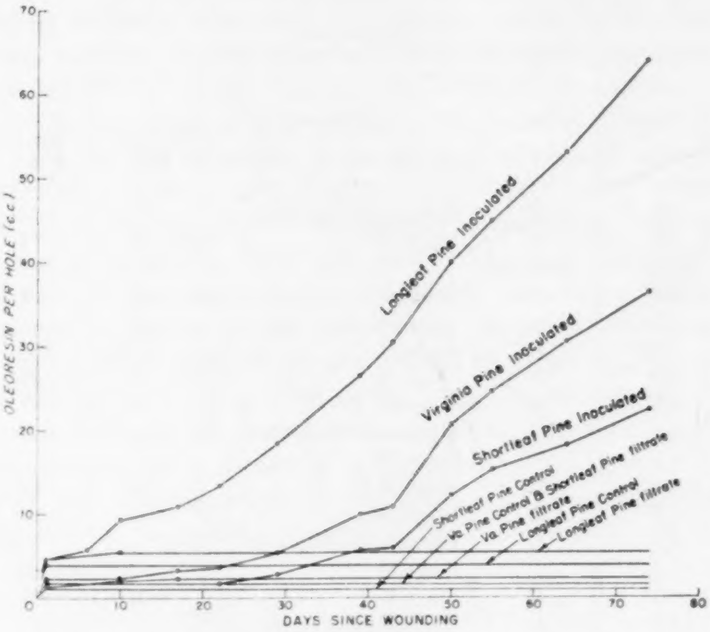



FIG. 1. Mean cumulative volumes of oleoresin produced from untreated holes, from holes receiving sterile culture filtrate, and from holes receiving application of *Fusarium* spores.

gum flow, particularly in longleaf pine. Average gum production for the two inoculated holes on one of the longleaf pines was 120 cc. per hole over the 74-day period. The untreated holes on this tree yielded 4 cc. each.

The advantages of any such method of gum stimulation, giving high yields and providing a continuous gum flow without need of repeated chipping, are obvious. Gum stimulation by the pitch canker *Fusarium* will be investigated further to determine the ultimate effect of inoculation on the trees, the effect on gum yield over a period of years, and the many other factors connected with the possible use of this fungus in turpentining operations.

### References

1. Hepting, G. H., and Roth, E. R. *J. Forestry*, 1946, **44**, 742–744.
2. Ostrom, C. E., and True, R. P. *Naval Stores Rev.*, 1946, **56** (35), 16, 26.

# Electrometric Studies in Women With Malignancy of Cervix Uteri

Louis Langman and H. S. Burr

*Department of Obstetrics and Gynecology, New York University College of Medicine; Obstetrical and Gynecological Service of the Third (New York University) Surgical Division, Bellevue Hospital;* and *Section of Neuro-Anatomy, Yale University School of Medicine*

A study is being made of the relatively steady state voltage gradient between the symphysis pubis and the cervix uteri in women with malignant and nonmalignant disease of the genital tract. A microvoltmeter, a recording galvanometer,

and Ag-AgCl electrodes were used in the determinations. One electrode was strapped on the lower abdomen above the symphysis pubis; the other, placed on or alongside the cervix. Using a chart speed of 1 inch in 2 minutes, records were taken for periods of 10–15 minutes. The results for the malignancies are shown in Table 1; for the nonmalignancies, in Table 2.

TABLE 1
MALIGNANCY

| Case | Age | Diagnosis | Mv | |
|---|---|---|---|---|
| | | | Initial P.D. | Mean P.D. |
| SR | 54 | Metastatic vagina T | −6 | −12 |
| MK | 94 | Stage IV | −21 | −27 |
| SR | (Repeat) | | −9 | −9 |
| RW | 65 | Stage IV | −27 | −28 |
| CB | 63 | Stage IV | −10 | −11 |
| MM | 54 | Stage II | −36 | −33 |
| MP | 45 | Stage IV | −30 | −22 |
| ET | 63 | Stage IV T | −36 | −37 |
| TD | 53 | Metastatic bladder Stage IV T | −45 | −45 |
| MM | 54 | Stage II T | −27 | −27 |
| CB | 63 | Stage IV | −10 | −13 |
| LJ | 51 | Fibroids–ovarian cyst Stage II | −3 | −6 |
| MD | 63 | Stage I | −21 | −25 |
| AS | 54 | Carcinoma of fundus | −3 | −7 |

T = Treated

The cases were selected from patients on the gynecological service in Bellevue Hospital and number 30. It will be noted

TABLE 2
NONMALIGNANCY

| Case | Age | Diagnosis | Mv | |
|---|---|---|---|---|
| | | | Initial P.D. | Mean P.D. |
| TM | | Fibroids | +9 | −3 |
| SR | 44 | Fibroids | +33 | +28 |
| LB | 32 | Pap serous cyst Adenoma | +33 | +27 |
| AD | 43 | Bleeding fibroids | −24 | −28 |
| WD | 22 | I.D. abscess P.I.D. | +6 | −12 |
| TD | 22 | Cystic ovary | +16 | +16 |
| FL | 22 | Menorrhagia | +6 | −3 |
| EJ | 27 | Fibroids P.I.D. | +3 | −3 |
| BM | 25 | Salpingitis Menorrhagia | +30 | +26 |
| MJ | 34 | Salpingitis Fibroids | −6 | −14 |
| MB | 57 | Bleeding from estrogen withdrawal | +30 | +30 |
| MR | 27 | Pregnancy, 3 months | +6 | −9 |
| TW | 28 | Pregnancy with bleeding | +21 | +17 |
| ER | 46 | Amenorrhea | +30 | +28 |
| SE | 35 | Fibroids | +39 | +35 |
| MF | 22 | Condylomata Pregnancy, 5½ months | −21 | −25 |
| HL | 28 | Mild P.I.D. ovarian cyst | +24 | +20 |

that all the cases of malignancy showed a marked negativity of the region of the cervix with respect to the symphysis. In these patients the diagnosis was confirmed by pathological examination.

By contrast, the patients with nonmalignancy showed, under the same conditions, an almost uniform positivity of considerable magnitude in the region of the cervix. Three exceptions are to be noted, explanations for which require further study.

Treatment by X-ray therapy or by radium apparently does not affect the measurements.

The method employed in this study is obviously an adjunct to other diagnostic procedures, and in no sense should it be construed as a substitute for them. The study is being continued, and a full report will be made at a later date.

This preliminary account is offered in the hope that it will stimulate studies by others.

## The Effect of Combining Sodium Benzoate With Oral Penicillins[1]

EARLE H. SPAULDING, AMEDEO BONDI, JR., and ELIZABETH EARLY

*Department of Bacteriology and Immunology, Temple University School of Medicine, Philadelphia*

Diodrast (*8*), para-aminohippuric acid (*1, 6*), benzoic acid (*3*), and sodium benzoate (*2*) have been reported as effective in elevating and prolonging penicillin serum levels, possibly by competition for renal tubular excretion. Bronfenbrenner and Favour (*3*) obtained at least a 2-fold increase by combining benzoic acid orally with intramuscular injections of sodium penicillin. Bohls and co-workers (*2*), using a total dose of 8.4 grams of sodium benzoate orally and a mixture of aluminum potassium sulfate and penicillin intramuscularly, reported assayable serum levels 28 hours following a single 50,000-unit injection. These same authors made determinations on an oral tablet containing alum-precipitated penicillin and sodium benzoate. The published data show assayable levels in 6 out of 10 individuals 24 hours after a single 100,000-unit dose. Both groups of investigators used infected individuals as subjects.

During the course of studies on oral penicillin the authors examined several preparations in combination with sodium benzoate. The present communication deals primarily with the effects observed. The subjects were 10 healthy adults who, with one exception to be mentioned later, participated in the entire study. Neither the diet nor the fluid intake was restricted; but food and fluids were avoided for a minimum of 1½ hours before administration of penicillin. The compounds were tested at one-week intervals. In all instances the test dose was 100,000 units of penicillin either alone or together with 1.2 gram of sodium benzoate. Blood was collected ½, 1, 1½, 3, and 6 hours later for serum level determinations, which were carried out by the method of Randall, *et al.* (*9*) and controlled for antisubtilis factor as described by Chandler and co-workers (*4*).

[1] These studies were made possible by financial aid from Hynson, Wescott and Dunning, Inc., and Commercial Solvents Corporation.

The authors gratefully acknowledge the technical assistance of Catherine C. Dietz and Cecelia Chemerda.

The crystalline sodium salt[2] used in these studies was re-nstituted in water from the dried state. The aluminum lts[3] were received as unbuffered tablets with and without dium benzoate. The alum-precipitated, penicillin-sodium nzoate tablet is identical with that reported on by Bohls d co-workers (*2*). The crystalline potassium penicillin was ntained in gelatin capsules[3] and, when indicated, was taken

TABLE 1

AVERAGE SERUM CONCENTRATION IN UNITS/ML.

| Penicillin salt | Hours following administration (100,000 units) | | | | | |
|---|---|---|---|---|---|---|
| | ½ | 1 | 1½ | 3 | 6 | Average |
| dium | 0.038 | 0.018 | 0.012 | 0.003 | * | 0.014 |
| uminum | .009 | .015 | .015 | .006 | * | .009 |
| luminum + sodium benzoate | .078 | .101 | .090 | .027 | .003 | .060 |
| lum-ppt. + sodium benzoate | .054 | .094 | .094 | .027 | .003 | .054 |
| otassium | .050 | .040 | .021 | .009 | * | .024 |
| otassium + sodium benzoate | .100 | .136 | .062 | .024 | .012 | .067 |

* No assayable level with any of the 10 subjects.

t the same time as, but separately from, the sodium benzoate blets.

The average serum concentrations for the 10 subjects appear n Table 1. To facilitate comparisons, the over-all averages for ach preparation are also presented. In the absence of sodium enzoate none of the penicillin salts produced an average vel above 0.05 unit/ml. or an assayable level at 6 hours. In ontrast, the simultaneous administration of sodium benzoate sulted in maximum averages approximating or exceeding .1 unit/ml. and, in some instances, assayable levels at 6 hours.

The striking variation in individual response deserves mphasis. When averages were computed from the levels pro-duced by each subject for all six preparations, it was found hat the figures ranged from .009 to .073, an 8-fold difference. ne subject did not show a single assayable level when the enzoate salt was omitted. In contrast, another subject ac-counted for all of the 6-hour levels recorded in Table 1. In passing, it should be mentioned that a subject who produced elatively high levels with one preparation also did so with the emaining preparations. Similarly, the "poor absorbers" re-mained relatively low, regardless of the preparation being mployed. Because individuals vary markedly in their ability to absorb orally administered penicillin, the indiscriminate se of any one such preparation is not justified until it can e demonstrated that none of a large number of test subjects ails to develop therapeutically effective serum levels.

The inaccuracy of serum penicillin determinations has been epeatedly emphasized by the authors cited earlier. Although he alum-precipitated, penicillin-benzoate tablet included in he present study is apparently identical with that employed y Bohls and co-workers (*2*), the high and prolonged levels eported by those authors were not seen. As an explanation or the discrepancy it should be pointed out that their subjects ere infected persons who might be expected to show higher evels than normal individuals and who are reputed to pro-duce larger amounts of antisubtilis factor (*5*). Certain of the prolonged levels reported by Bohls could have been due to antisubtilis factor which was apparently not taken into con-sideration. With respect to the present study, however, no instance of complete inhibition was observed in the clarase controls.

The present authors were impressed by the need of close inspection of the tests for evidence of growth. The test or-ganism (*Bacillus subtilis*, N.R.R.L. #558) usually developed in broth (2 per cent tryptose extract) as a sediment with some diffuse turbidity rather than as a pellicle. Careful observation often revealed a small amount of sedimented growth or a faint turbidity. Final readings were made after 21–24 hours incuba-tion, and the levels were frequently lower than those recorded 5 hours earlier. Therefore, a standardized incubation time is desirable.

The ability of sodium benzoate to increase and prolong serum levels appears to be established. The choice of a dose of 1.2 gram/100,000 units, as employed in the present study, was purely arbitrary. In view of the relatively innocuous nature of this compound (*7*), the value of using larger amounts in combination with oral penicillin should be determined.

One subject in the present study developed a reaction which was attributed to penicillin sensitization. Fifteen minutes after the administration of the third compound urticaria appeared, followed later by edema. No other untoward effects were noted.

[2] Kindly supplied by Dr. L. W. Smith, of Commercial Solvents Corpora-tion.

[3] Kindly supplied by Dr. Roger Reid, of Hynson, Wescott and Dunning.

## References


1. BEYER, K. G., VERWEY, W. F., WOODWARD, R., PETERS, L., and MALTIS, P. A. *Amer J. med. Sci.*, 1945, **209**, 608.
2. BOHLS, S. W., COOK, E. B. M., and POTTER, R. T. *J. ven. Dis. Inf.*, 1946, **27**, 69.
3. BRONFENBRENNER, J., and FAVOUR, C. B. *Science*, 1945, **101**, 673.
4. CHANDLER, V. L., PRICE, C. W., and RANDALL, W. A. *Science*, 1945, **102**, 355.
5. ELIAS, W. F., MERRION, H. J., and SPEICHER, T. *Science*, 1945, **102**, 223.
6. LOEWE, L., ROSENBLATT, P., ALTURE-WERBER, E., and KOZAK, M. *Proc. Soc. exp. Biol. Med.*, 1945, **58**, 298.
7. QUICK, A. J. *J. Amer. med. Ass.*, 1944, **124**, 1219.
8. RAMMELKAMP, C. H., and BRADLEY, S. E. *Proc. Soc. exp. Biol. Med.*, 1943, **53**, 30.
9. RANDALL, W. A., PRICE, C. W., and WELCH, H. *Science*, 1945, **101**, 365.


# Action of Thiamine Applied Directly to the Cerebral Cortex


M. VIANNA DIAS

*Division of Physiology, Instituto Oswaldo Cruz, Rio de Janeiro*


It is generally claimed that vitamin $B_1$ (thiamine) exerts influence on the nervous functions. This assumption is based more on data obtained from deficiency states than on an effec-tive action of thiamine on the specific functions of the nervous system. Indeed, it has been verified that this vitamin presents no typical or characteristic pharmacological effect on normal animals. Large doses by the intravenous route are tolerated, showing only discrete reactions in the blood pressure or urinary excretion (*7, 12*). Death occurs by respiratory failure (*12*).

On the other hand, there is some experimental evidence indicating a possible association of thiamine with acetylcholine in the processes of nervous excitation. Binet and Minz (*3*) have

obtained liberation of a particular substance from the vagus and other nervous trunks, *in vivo* and *in vitro*, by repetitive electrical excitation. This substance, which potentiates various effects of acetylcholine, was later identified by Minz (*9*) as thiamine. Recently, in a similar manner, Von Muralt (*16*) has described liberation of thiamine, in addition to acetylcholine, by electrical stimulation of cholinergic nerves. According to the latter, "aneurin (*i.e.* thiamine) is a reservoir substance closely connected with the formation and disappearance of acetylcholine."

In another field it has been shown that thiamine potentiates and increases the action of acetylcholine on the dorsal muscle of the leech (*11, 13, 15*), isolated intestinal loop (*1, 2, 5*), arterial pressure (*2, 13*), blood vessels of the frog (*4*), and frog "rectus abdominis" muscle (*13*). Thiamine also intensifies the effects obtained by stimulation of certain nervous trunks (*10*). It was also independently found by various investigators that cholinesterase is inhibited by thiamine (*6, 8, 14*).

In order to study the action of thiamine on the central nervous system, we performed a series of experiments on 45 dogs, applying the referred substance directly and circumscribely to the cerebral "motor" cortex.

The animals were craniectomized, and a small region of the cortical "motor" area of one side was exposed. One of the "motor" points that elicited, by a minimum intensity of electrical stimulation, contractions of the contralateral eyelids (m. orbicularis oculi) and extension or flexion of the contralateral forelimb was determined by unipolar excitation.

We have used thiamine hydrochloride in solutions of 1, 2, 5, and 10 per cent, dissolved in physiological saline solution. A small, square filter paper, 3–3.5 mm. square, was soaked with the solution assayed and directly applied to one of the "motor" points previously located. The filter papers with the thiamine solution were substituted at regular intervals of 5–7 minutes, according to the requirements of the experiments. All observations were made on animals in an unanesthetized state.

We have observed that thiamine hydrochloride (2–10 per cent sol.) applied directly to the cerebral cortex, after 1–2 minutes, gives rise to motor reactions consisting of rhythmic contractions (clonus) of the muscle or muscular group corresponding to the cortical "motor" point submitted to the action of the substance. Initially, the rhythmic muscular reactions are weak and sometimes with irregular sequence, but generally, within 1–3 minutes after their appearance, the intensity is increased and the clonus well marked by rhythmic and regular contractions. With a second application of thiamine on the cortex, 6 minutes after the beginning of the experiment, the localized muscular clonus becomes stronger and better characterized, showing a definite increase in intensity and frequency of the contractions.

Usually, afferent, repetitive, mechanical stimulation of the cutaneous region connected with the muscle which is in rhythmic action, corresponding to the cortical "motor" point under the action of thiamine, increases the intensity or frequency of the motor reactions, or both.

Sometimes peripheral cutaneous stimulation determines a typical effect of facilitation on the muscular rhythmic contractions, which show a pronounced increase in intensity and frequency. Instead of being intermittent, the contractions become continuous, occurring one after another without interruption and with increasing frequency. On the other hand, the contractions may become vigorous, showing a progressive increase in intensity, with a marked tonic component on the clonic reactions. Then, the motor phenomena present the aspect of a localized convulsive reaction. With further peripheral cutaneous or simply spontaneous stimulations, it was possible to obtain gradual and progressive generalization of the motor convulsive reactions to other muscular groups of the animal, in a Jacksonian manner. When all skeletal musculature is involved, a typical and completely generalized epileptiform convulsion takes place, developing with the typical tonic-clonic sequence. After the convulsion stops, the former localized muscular clonus persists, presenting contractions with good intensity and frequency.

We were able to obtain epileptiform convulsions in 34 of the 45 dogs, using 2–10 per cent thiamine hydrochloride solution on the cerebral cortex. In some dogs, the convulsions were produced in 4–10 minutes after the beginning of the experiment, with only one or two applications of thiamine hydrochloride. In others, epileptiform fits occurred after a longer period (16–27 minutes), such a reaction depending on the convulsive predisposition of the animal as well as on the degree of concentration of the solution used. Employing 2 per cent thiamine hydrochloride solution, the time required to obtain a generalized epileptiform convulsion was greater than that observed with more concentrated solutions (5–10 per cent).

In some animals (11 dogs), only localized muscular clonic reactions could be obtained, even though 5–10 per cent solutions were used over a period of 30–35 minutes, with successive renovation of the substance each 6 minutes. These animals were considered as "not predisposed."

In the experiments performed with 1 per cent thiamine hydrochloride solution, we obtained only localized muscular clonus, generally weaker than that produced with more concentrated solutions. In some animals, the motor rhythmic reactions presented a transitory convulsive aspect, but they always remained restricted to the muscle related to the cortical "motor" point submitted to the action of thiamine, and no generalized convulsive reactions were observed.

Using the same technique, we tried diphosphothiamine (cocarboxylase) in 2 and 5 per cent solutions, identical results being obtained. All animals showed localized muscular clonus, and in 2 of the 5 dogs studied generalized epileptiform convulsions were observed.

Experiments were made with the two separate thiamine moieties: pyrimidine and thiazole. The cortical application of 2-methyl-5-ethoxy-methyl-6-aminopyrimidine (10 per cent sol.) and 4-methyl-5-beta-hydroxyethylthiazole (pure liquid substance) gave negative results, no motor reactions being observed. Each of the two substances was applied to the cerebral cortex for 30 minutes, the drug being renewed each 6 minutes.

Other hydrosoluble vitamins, pyridoxine hydrochloride (5 per cent sol.), niacinamid (5 and 10 per cent sol.), and ascorbic acid (5 and 10 per cent sol.), applied to the cerebral cortex for 30 minutes with regular renewal of the substance, proved to be ineffective in producing any kind of muscular reaction.

## References


1. Abderhalden, E., and Abderhalden, R. *Pflüg. Arch. ges. Physiol.*, 1938, **240**, 388.

2. AGID, R., BEAUVALLET, M., and MINZ, B. *C. R. Soc. Biol. Paris*, 1937, **126**, 982.
3. BINET, L., and MINZ, B. *Arch. int. Physiol.*, 1936, **42**, 281.
4. BRECHT, K. *Pflüg. Arch. ges. Physiol.*, 1940, **243**, 714.
5. BYER, J., and HARPUDER, K. *J. Pharm. exp. Therap.*, 1940, **70**, 328.
6. GLICK, D., and ANTOPOL, W. *J. Pharm. exp. Therap.*, 1939, **65**, 389; *Proc. Soc. exp. Biol. Med.*, 1939, **42**, 396.
7. HECHT, G., and WEESE, H. *Klin. Wschr.*, 1937, **16**, 414.
8. MASSART, L., and DUFAIT, R. *Naturwiss.*, 1939, **27**, 567.
9. MINZ, B. *C. R. Soc. Biol. Paris*, 1938, **127**. 1251.
10. MINZ, B *C. R. Soc. Biol. Paris*, 1939, **131**, 1156.
11. MINZ, B., and AGID, R. *C. R. Acad. Sci., Paris*, 1937, **205**, 576.
12. MOLITOR, H., and SAMPSON, W. L. *Merck's Jahresberich*, 1936, **50**, 51.
13. SOLLERO, L. Thesis. Rio de Janeiro, 1944.
14. SÜLLMANN, H., and BIRKHAÜSER, H. *Schweiz. med. Wschr.*, 1939, **27**, 567.
15. VON BRÜCKE, F. TH., and SARKANDER, H. *Arch. exp. Path. Pharmakol.*, 1940, **195**, 218.
16. VON MURALT, A. *Nature, Lond.*, 1944, **154**, 767.

# Bacillary Dysentery and Chronic Ulcerative Colitis in World War II

JOSEPH FELSEN and WILLIAM WOLARSKY

*Pan-American and International Dysentery Registry, The Bronx Hospital, New York City*

Bacillary dysentery has long been recognized as a major military disease. Next to malaria, it was the prevailing disease, during World War II, among the American forces in tropical areas and the second greatest disease threat in number of cases among overseas troops. Since 1933 a rather striking increase in incidence of the disease among civilians throughout the world has also been noted. In the United States the number of reported cases in 1944 was approximately 60 times greater than in 1933.

The subject of bacillary dysentery has been recently reviewed elsewhere (*1*). There is, however, a great paucity of data regarding the chronic manifestations of the disease. Evidence has been presented that these appear as diffuse cicatrizing, ulcerative, polypoid lesions of the small and large bowel known as regional ileitis (enteritis) and chronic ulcerative colitis. This view has met with considerable resistance in some circles, although typical chronic ileitis and ulcerative colitis have been demonstrated in many individuals followed from the acute to the chronic phase. The first extensive group follow-up was that of the atypical Flexner dysentery epidemic which occurred in Jersey City in 1934 (*2*). Of 210 patients hospitalized at the Medical Center, 122 were studied for periods varying from 9 to 12 months. Of the latter, 10.7 per cent developed chronic ulcerative colitis or ileitis. Subsequent studies elsewhere by other investigators have closely approximated this figure, so that we may reasonably assume that 1 of 10 patients with acute bacillary dysentery will probably develop the chronic form of the disease—usually ulcerative colitis. One of the major contentions of those opposing the bacillary dysentery etiology of chronic ulcerative colitis is that, if true, we should see many instances in connection with wars, since bacillary dysentery is largely a military disease.

The present communication concerns 61 cases of chronic ulcerative colitis occurring in American military personnel, including some war prisoners, of World War II. Of the total, 50 were studied from 5 to 30 months after the onset of diarrhea. In the remainder, the symptoms and signs were of slightly shorter or longer duration than the period specified. In 33 instances, the onset of the disease was definitely traced to outbreaks, 3 of them occurring aboard transports and 30 in military camps. Almost all patients incurred their initial acute bacillary dysentery in known endemic and epidemic areas, chiefly New Guinea, India, the Philippines, and North Africa. Accurate bacteriologic data during the acute phase was sparse, due to the lack of adequate laboratory facilities or the stress of combat service. In 5 of the outbreaks, *Shigella paradysenteriae* (Flexner's bacillus) was isolated. Confirmatory epidemiologic evidence was sometimes obtained in cases where initial cultural studies were not carried out. This consisted of positive cultures for *B. dysenteriae* in other military personnel who had diarrhea at the same time and place as those who were not studied bacteriologically. All cases were diagnosed as "dysentery," "GI's," "intestinal infection," "gastroenteritis," or "Delhi belly"—terms which, on the basis of previous studies, are now recognized as being practically synonymous with bacillary dysentery. All patients were treated with sulfonamides.

The general clinical picture during the acute phase in all patients included in this report was the abrupt onset of abdominal cramps, diarrhea, and fever. The bowel movements were watery, mucopurulent, or bloody. In 5–10 days these symptoms and signs subsided only to be followed by the characteristic postdiarrheal phase of constipation (healing phase). No sigmoidoscopic studies were made during the acute stage. There followed recurring episodes of bloody diarrhea, and in 8 patients the diagnosis of chronic ulcerative colitis was subsequently made in military hospitals. Fifty of the 61 patients were subjected to sigmoidoscopic study 5–30 months after their initial infection. All patients exhibited the typical hyperemic, granular mucosa or ulceration and purulent cytology of the mucosal exudate. Mural fibrosis and luminal stenosis were usually present only in cases of long duration (a year or more). Five patients in the present series also exhibited a concomitant distal ileitis, one confirmed by X-ray.

Of 12 patients receiving fecal cultures during the acute phase, 5 (41.6 per cent) were positive for *B. dysenteriae.* Of the 61 patients examined by us during the chronic phase, 6 (9.8 per cent) revealed *B. dysenteriae* by the mucosal crypt aspiration method. One patient exhibited positive cultures during both acute and chronic phases. Thus, out of a total of 61 patients with chronic ulcerative colitis, 10, or 16.4 per cent, exhibited positive cultures. This figure is significant since so few were studied initially, and the recovery of the dysentery organism in 9.8 per cent after 5–30 months appears in marked contrast to our control group where the incidence is 0.08 per cent.

The evidence presented is deemed to be of sufficient importance to lend additional support to our contention that chronic ulcerative colitis and ileitis are the result of acute bacillary dysentery. It is of particular relevancy at this time, since many of our veterans are finding it difficult to establish service-connected disability in chronic ulcerative colitis and ileitis because the initial acute phase has been forgotten or inaccurately diagnosed. It is quite probable that the present series of 61 cases forms but a small fraction of the actual number occurring in veterans of World War II.

### References

1. FELSEN, J. *Bacillary dysentery, colitis and enteritis.* Philadelphia: W. B. Saunders, 1945.
2. FELSEN, J., and GORENBERG, H. *Amer. J. med. Soc.*, 1936, **192**, 553.

## The Maceration of Woody Tissue With Acetic Acid and Sodium Chlorite

WALTER E. SPEARIN and IRVING H. ISENBERG

*The Institute of Paper Chemistry, Appleton, Wisconsin*

A simple chemical treatment which would separate cells for microscopic examination without mutilation would be helpful to the wood anatomist. The method commonly in use at present is extremely drastic, inasmuch as it consists of treatment of the wood sample with nitric acid and potassium chlorate, reagents which may seriously injure some of the fibers, particularly in the hands of inexperienced workers. A less drastic treatment (chlorine and sodium sulfite) has been suggested by Harlow (*1*), but this requires considerable manipulation.

TABLE 1

MACERATION OF WOODY TISSUES
(based on 1 gram of air-dry wood)

| Schedule | Size (in.) | Time* (hrs.) | Water† (ml.) | Acetic acid (drops) | Sodium‡ chlorite (grams) | Average temperature (°C.) |
|---|---|---|---|---|---|---|
| 1 | 1/8 x 1/8 x 3/4 | 0 | 35 | — | — | 90 |
| | | 1 | — | 5 | 0.6 | |
| | | 1 | — | 5 | 0.6 | |
| | | 1 | — | 5 | 0.6 | |
| | | 1 | — | 5 | 0.6 | |
| | | 1 | — | 5 | 0.6 | |
| 2 | 1/8 x 1/8 x 3/4 | 0 | 35 | — | — | 85 |
| | | 1 | — | 30 | 5.0 | At 85 for 1 hr., then allowed to stand overnight at room temperature |
| | | 3 | — | 6 | 1.0 | |
| 3 | 1/16 x 1/8 x 3/4 | 0 | 35 | — | — | 85 |
| | | 3 | — | 12 | 2.0 | |
| | | 3 | — | 6 | 1.0 | |

* Following expulsion of air from sticks; solution may be left overnight at room temperature at any point.

† The liquor-wood ratio is not critical.

‡ Analytical grade was used, but the technical grade is much cheaper and probably just as satisfactory, because the solution is not highly acid.

The removal of lignin from wood by treatment with acidified sodium chlorite, for the preparation of holocellulose, has been explored recently (*2–4*). This is accomplished with negligible loss of carbohydrate material, unless one attempts to remove all the lignin during the treatment; the tissue is simultaneously bleached. Since a slight loss of the carbohydrate fraction would not mutilate the cell elements for purposes of fiber identification, more drastic treatment than that given in the above references suggests itself for the maceration of woody tissues.

Four species of wood were used in our experiments: Loblolly pine (*Pinus tæda*), red spruce (*Picea rubra*), buckeye (*Aesculus* sp.), and black gum (*Nyssa sylvatica*). Several series of tests were made, using different conditions of time, temperature, and concentration. The schedules given in Table 1 will serve as guides for satisfactory results.

In all these experiments the black gum wood was more resistant to the chlorite, and it was necessary to repeat the final step listed to obtain complete maceration. Actually, sufficient material separates for the desired purpose at the end of the tabulated schedules. Each species presents a separate problem, however, and the person making the macerations must adjust conditions to give best results. The thickness of the sticks is an additional factor to consider.

The method is as follows: (1) Split out material of match-stick size (approximately 1/8 x 1/8 x 3/4 inch); (2) remove the air by boiling, soaking, or evacuation; (3) follow through one of the schedules of chloriting as given in Table 1; (4) wash; and (5) shake to separate the fibers.

Certain precautions must be observed. The acetic acid must be added *before* the sodium chlorite in each step, and a hood and reflux must be used. In connection with the latter, an Erlenmeyer flask, with an inverted smaller Erlenmeyer or volumetric flask in the neck, is convenient. Finally, easily oxidizable material, such as rubber or sulfur, must be kept away from the sodium chlorite in order to obviate explosion.

### References

1. HARLOW, W. M. *Bot. Gaz.*, 1928, **85**, 226–227.
2. JAYME, G. *Cellulosechem.*, 1942, **20**, 43–49.
3. LOVELL, E. L. *Ind. eng. Chem.*, 1945, **37**, 1034–1037.
4. WISE, L. E., *et al. Paper Trade J.*, 1946, **122**, No. 2, 35–43.

## A Tunnel Clamp for Use in Controlling Infusion Rates

STANLEY E. BRADLEY

*Evans Memorial, Massachusetts Memorial Hospitals, and Department of Medicine, Boston University School of Medicine*

The rate of inflow of intravenous, intramuscular, or subcutaneous infusions is ordinarily controlled by a pinchcock of one type or another. Since the head of pressure that drives fluid through the needle remains quite high and relatively constant, and since the venous, muscular, or tissue tension opposing inflow is relatively small, the rate of flow is primarily a function of the resistance offered by the tubing and needle. With an ordinary pinchcock, the resistance is adjusted by changing the diameter of a short segment of the tubing. However, small spontaneous changes in the diameter of the short, constricted region may occur and cause large variations in

resistance. This variation is greatly reduced and the rate of inflow more easily controlled when the region of constriction is extended by use of a long clamp.

The instrument described here is similar to that used by a group working on problems of renal physiology in man and animals in the Department of Physiology and Medicine, New

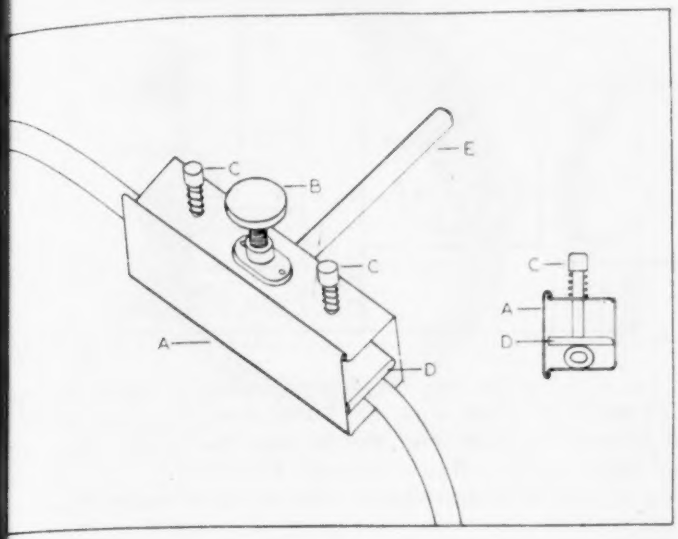



Fig. 1

York University College of Medicine, under the direction of Homer W. Smith. It was originally designed by J. E. Shannon and has been modified for use in clinical work at the Massachusetts Memorial Hospitals.

The clamp[1] (Fig. 1) is constructed of nickel-plated brass with all attached parts riveted and joined with high-melting-point solder to permit sterilization. It is 4 inches long, and $\frac{3}{4}$ inch square in cross-section. The outer side is closed by a metal slip (A), so designed that the construction becomes tighter as the tubing is compressed. Uniform compression of the rubber tubing is assured by bolstering the centrally placed adjustment screw (B) by two pins (C) passing through a lateral wall of the clamp affixed to the compressor plate, and held in place by steel springs that expand between the terminal head of the pins and the lateral wall of the clamp to keep the compressor blade pressed against the adjustment screw. The pins are placed $2\frac{1}{2}$ inches apart, $\frac{3}{4}$ inch from each end of the clamp. A short bar (E) may be attached to the inner wall to support the clamp independently of the tubing.

This clamp has found intensive use whenever constant inflow rates are necessary, as, for example, in renal clearance (*3, 4*) and hepatic blood flow (*2*) determinations, the administration of penicillin (*1*), and other chemotherapeutic agents. Where very slow rates of inflow (1–2 ml./minute) over long periods of time are required, as with the intramuscular injection of penicillin or the parenteral administration of fluids to infants, it has proved particularly valuable.

### References


1. Anderson, D. G. *New Engl. J. Med.*, 1945, **232**, 400–405, 423–429.
2. Bradley, S. E., Ingelfinger, F. J., Bradley, G. P., and Curry, J. J. *J. clin. Invest.*, 1945, **24**, 890–897.
3. Goldring, W., and Chasis, H. *Hypertension and hypertensive disease.* New York: Commonwealth Fund, 1944.
4. Smith, H. W., Goldring, W., and Chasis, H. *J. clin. Invest.*, 1938, **17**, 263–278.


[1] This instrument may be obtained from the Harvard Apparatus Company, Dover, Massachusetts.

## An Improved Alcohol Check for Rat Metabolism Apparatus


Irving Goodman and R. G. Gustavson
*University of Colorado, Boulder*


In connection with the open-circuit determination of basal metabolic rates of small animals, one of the most troublesome problems which arises is a method of alcohol combustion which will produce carbon dioxide at a rate comparable to that of the animal and yet result in complete combustion, thus allowing

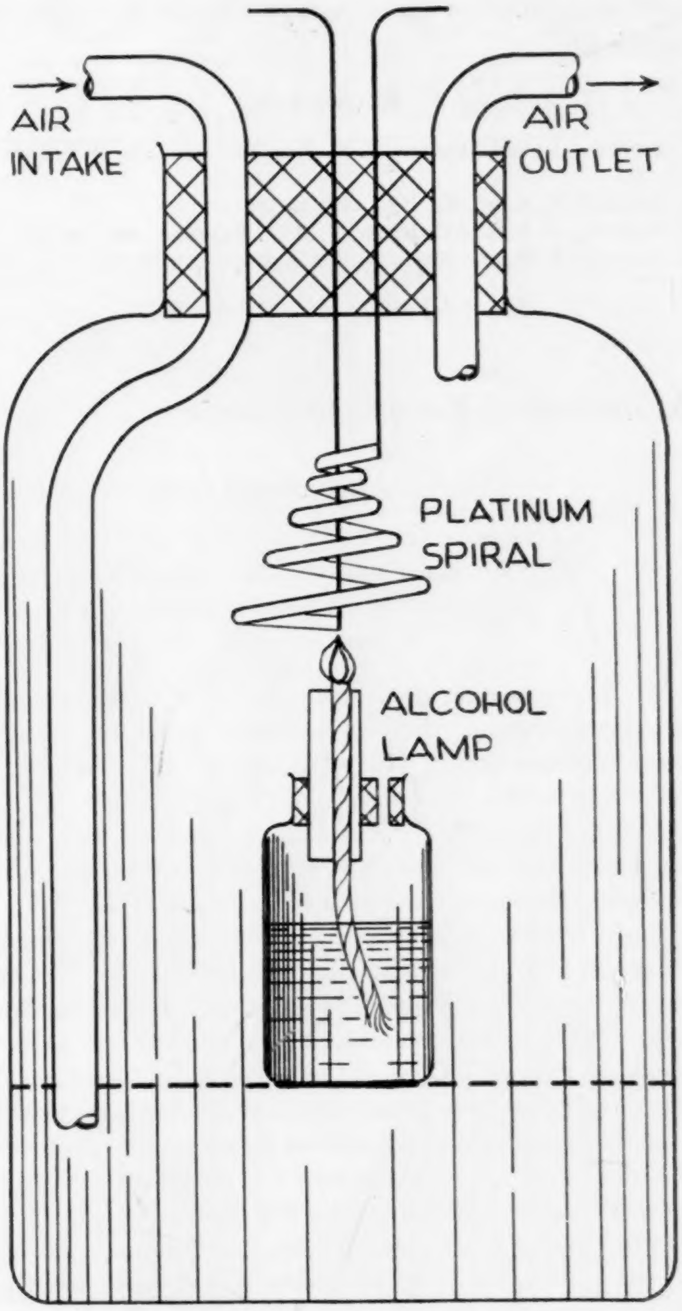



Fig. 1

for an accurate check on a theoretical respiratory quotient (R.Q.). Schwabe and Griffith (*3*) encountered this difficulty and finally resorted to the mechanical withdrawal of oxygen and addition of carbon dioxide at rates comparable to those encountered in their experimental work with rats. Bunnell and Griffith (*1*) devised a metabolism check apparatus using illuminating gas. This method, however, is subject to criticism unless analyses of the illuminating gas are reported.

Other methods have been used for checking larger metabolism machines. Among these are the complicated radiating alcohol burner of Jones (*2*), which is exceedingly cumbersome, and the ingenious method of Shelley and Hemingway (*4*), using a detachable, electrically ignited lamp that may be weighed before and after burning, which is not applicable to work with small animal chambers.

After many unsatisfactory attempts at obtaining a reasonable R.Q. for methyl alcohol, using a small alcohol lamp, an electrically heated platinum spiral, suspended above the small alcohol flame, resulted in complete combustion as demonstrated by the R.Q. The following R.Q.'s were obtained in burning absolute methyl alcohol in this manner: 0.673, 0.669, 0.659, 0.670, 0.655, with an average of 0.665. The theoretical value is 0.667.

### References


1. Bunnell, I., and Griffith, F. R. *Proc. Soc. exp. Biol. Med.*, 1940, **44**, 509.
2. Jones, H. M. *J. lab. clin. Med.*, 1929, **14**, 750.
3. Schwabe, E. L., and Griffith, F. R. *J. Nutrition*, 1938, **15**, 187.
4. Shelley, W. B., and Hemingway, A. *Science*, 1940, **91**, 99.


## A Simplified Encephalophone


Matthew Conrad and Bernard L. Pacella

*Department of Experimental Psychiatry, New York State Psychiatric Institute and Hospital,* and *Department of Psychiatry, College of Physicians and Surgeons, Columbia University*


A simple adapter has been developed which converts the low-frequency varying voltages observed with an electroencephalograph into variations in the pitch of an audible tone. An instrument which accomplishes this has already been described (*1*), but it is felt that the present highly simplified circuit will make this method more readily available to those who may wish to explore its possibilities.

Fig 1. is a schematic diagram of the adapter. The type 884 thyratron is used in a relaxation oscillator circuit. The condenser, $C_1$, is charged through the resistors, $R_1$ and $R_2$. When sufficient charge has accumulated on $C_1$ to raise its potential to the breakdown voltage of the 884, the condenser will discharge quickly through the tube, and the small resistor, $R_3$, until the condenser voltage reaches the maintaining voltage of the tube, at which point the tube will cease conducting. The cycle of charging and discharging will occur repeatedly, giving rise to audio-frequency oscillations, the frequency of which depends mainly on the time required for the condenser, $C_1$, to charge up to the breakdown voltage of the 884. Frequency modulation of these oscillations may therefore be accomplished by varying the potential of the grid of the 884, thereby varying the breakdown voltage of the tube.

The oscillations generated by the thyratron circuit are amplified in a single-stage amplifier, using a type 6K6 tube, and applied to a loud-speaker. A single 45-volt battery has been found entirely adequate for the plate supply. The current drain is only about 6 milliamperes. The heaters may be supplied by a transformer. If it is desired to obtain power for this adapter from the electroencephalograph with which it is used, care should be taken to see that the plate supply voltage applied to the adapter is within the range of about 40-100 volts. Stable operation outside of this range is unlikely with the circuit constants given.

Three controls are used in the operation of the adapter. The mean pitch of the tone is adjusted by varying $R_1$. Control

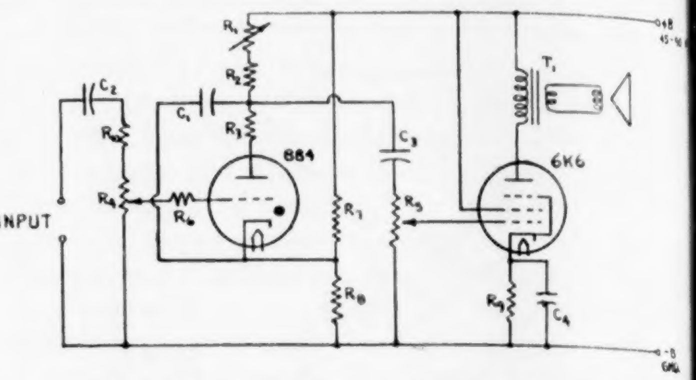



Fig. 1. $R_1$—100,000-ohm linear potentiometer; $R_2$—50,000 ohms; $R_3$—2,000 ohms; $R_4$—50,000 ohms; $R_5$—200,000 ohms; $R_6$—10,000 ohms; $R_7$—100,000 ohms; $R_8$—7,500 ohms; $R_9$—500 ohms; $R_{10}$—750,000 ohms; $C_1$—0.02 mfd.; $C_2$—1.5 or 2.0 mfd.; $C_3$—0.03 mfd.; $C_4$—25 mfd., 25 volts; $T_1$—10,000 ohms to voice coil; loud-speaker—5-inch permanent magnet dynamic.

over the sensitivity, or ratio of pitch deviation to input signal, is effected by the potentiometer, $R_4$. The loudness of the tone may be adjusted by means of the volume control, $R_5$. At maximum sensitivity a 50 per cent increase in audio-frequency is obtained when the grid of the 884 is made more positive by 1 volt.

The input terminals of the adapter are connected across the writing mechanism of the electroencephalograph. In most commercial electroencephalographs this connection may be made by means of binding posts on the writing mechanism unit. Sufficient voltage to operate the adapter will be available on any of the magnetic or piezoelectric writing mechanisms in current use. The adapter may be left permanently connected across the writing mechanism terminals, even when not in use.

The adapter was attached first to a low-frequency oscillator in order to test its response. Waves of about 8–12 cycles produced the effect of a fast musical vibrato applied to the tone. Waves in the range above 20 cycles produced a roughening of the tone that was decidedly unmusical—somewhat like the sound of a hornet. Waves of about 5–7 cycles produced the sensation of a musical vibrato of slow to moderate rate, while slower waves of about 1–4 cycles sounded more like a gliding variation in pitch which could be followed continuously.

Similar results were obtained when the adapter was attached to an electroencephalograph and human subjects were used. With a little practice, it was possible to estimate the frequency of the predominant activity quite closely by listening to the frequency-modulated tone.

The apparatus may be simplified by eliminating the power output stage and speaker and substituting headphones. This has the added advantage of confining the sounds only to the listener and eliminating any disturbing effect which they may have upon the subject and the recorded potentials, since auditory stimuli may affect the EEG pattern.

### Reference


1. Furth, R., and Beevers, C. A. *Nature, Lond.*, 1943, **151**, 111; *Electronic Eng.*, 1943, **15**, 419.